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New Advertisements.

In the growth of THE ELECTRICAL WORLD in circulation, size and general improvement, the value of its columns for reaching those engaged in electrical pursuits or interested in electrical matters has not failed to be appreciated by advertisers. Readers will find it to their advantage to keep their eyes on the advertising as well as the reading columns. The following are the new advertisements in this issue:

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VOL. X. NEW YORK, DEC. 31, 1887. No. 27.

WE present with this issue a complete Index for Volumes IX. and X., together with a title page for THE ELECTRICAL WORLD for 1887. The index has, like the paper itself, grown steadily from year to year, until it is now with difficulty compressed into three solid pages of small type. It has another feature of interest in showing how the importance of various unfamiliar branches is developed from time to time, and how rapidly some of the younger applications are growing, as, for example, electric power and electric storage. The manner in which both of these new departments are gaining ground, and making demands for space and consideration, is well illustrated in the extent to which they fill the Index; and in this respect it is significant, too, that while so much room is required for record of the work done in dynamic electricity so little is taken up by advances in static electricity, which is even being left in the rear by thermo electricity. Viewing the Index as a whole, it is one, we think, that any paper might well be proud of, as evidence of the manner in which its columns are devoted to all the investigation, discovery and progress of the year in its chosen field. THE ELECTRICAL WORLD has contained during the year no fewer than 608 reading pages and about 1,000 illustrations, many of which were large wood-cuts of the best artistic quality. Some issues have run as high as between 50 and 60 pages, and the average issue has reached from 28 to 32 pages of reading and advertisements. It goes without saying that such a paper could only be carried on with a very large subscription list and circulation, and we are glad to say that with the recognition that has come of our efforts and resolve to publish a journal conducted with the strictest independence, and devoted to the best interests of the electrical profession and industry, our previous rate of increase has been far exceeded. During the past year we have often been grateful for the voluntary help given us by friends, correspondents and contributors in rendering the paper more valuable to its readers, and we feel that the best return which can be made for such support is to set higher than ever the standard of excellence at which we aim.

OUR English correspondence gives a list this week of the central electric lighting stations in England. It is a very short list, but congratulations are in order that it can be compiled at all, for the course of legislation has been directly against the creation of such plants. It is to be noted that several of the stations named are on the alternating system, and that a variety of "transformers" are used. It is also to be noted that such well-known American names as Edison, Brush and Thomson-Houston figure prominently.

A STRIKING evidence of the change that has come over the direction of electrical thought and work is to be seen in the determination of the English Society of Telegraph Engineers and Electricians to take a new name, and to be known hereafter as the Institution of Electrical Engineers. This seems to us an eminently wise step, and one that must be attended with the best results. The electrical engineer has now a well established place, and the name is so comprehensive that in England as well as in America it will now stand fitly as part of the title of the national technical body representing the profession.

THE Light-House Board is about to undertake experiments in a work which will have an important bearing on the lighting of dangerous points in our rivers and harbors. It is nothing less than the lighting of buoys by electricity. The method at present in use for illuminating buoys consists in supplying them with oil or gas. With both of these it is necessary to replenish the source of illumination periodically, and this means additional trouble and expense. Besides, in most cases, the buoy is allowed to remain constantly lighted, as it is not visited daily. Hence it appears that the electric light is especially adapted to this purpose, as it requires no attention whatever and is under control at all times. The programme of tests to be carried out by the Board is given by Mr. H. A. Reed in another column.

WE conclude this week the description of the meters used in the installations of the Edison Company. The two articles published will give a very good idea of the necessity of accuracy in the maintainance of incandescent lights. One of the standards employed in the instrument described is a portable Daniell cell which remains unchanged in its indication for several months. The Latimer Clark cell, though an admirable one as a standard, is somewhat difficult to prepare, and labors under the great disadvantage that it cannot be easily transported without disturbing its constituents so that its indications are no longer accurate. Hence, as a rule, standard cells of this type are sold without a guarantee of accuracy. The portable standard Daniell described has worked very well in practice, and though its E. M. F. is lower than that of the Clark cell its constancy under conditions of daily use makes it preferable to the latter.

THE meeting of telephone experts held in this city last week was the second of those called for the purpose of obtaining a consensus of the opinion of competent men upon the best means of improving the present conditions and methods of operating. The meetings of the National Telephone Exchange Association, no doubt, have had considerable influence in bringing about changes, but the conferences recently held are of a somewhat different nature, and being called specially for the purpose by the parent company are likely to have great effect on future telephone work. Thus, it may be mentioned that one of the conclusions arrived at was that in large cities it is advantageous to combine exchanges as much as possible under a single roof, but that the number of subscribers connected into one office ought not to exceed 5,000 in any one case. It is not improbable, therefore, that we may soon learn of the commencement of a number of large exchanges on the plan of that undertaken in this city. The course adopted in calling these meetings is to be commended, and their effect will, we hope, soon be felt in improved service.

THE report on another page of the discussion upon Mr. Arthur Steuart's Institute paper, "Revision of the Patent Law," will be found very interesting reading. The questions raised are of the first importance, and the number and standing of those who contribute their views shows how far the desire for reform occupies the thought of electricians, inventors and patent practitioners. It is evident that the patent system has been outgrown, "and if not revised will become more outgrown as the needs of the industrial arts develop in new lines," and this constitutes what may be termed the platform of the agitation. The desirability of reform is generally admitted, but many are disposed to doubt whether any movement seeking to improve the system now is timely. Some deem it inadvisable to seek changes, for the reason that the whole system may thus be imperiled for the sake of minor amendments; others think that presidential campaign years are bad ones for movements of this nature. While it is not very likely that the patent system, with all its many benefits, will be or could be sacrificed in this particular way, there is, perhaps, some weight in the contention that the time is not propitious. Still, if patent reform, as an issue claiming public attention, can hold its own with international copyright or with protection versus free trade, then it is as well to advocate it in 1888 as in 1889. The suggestion of Mr. George Ticknor Curtis, expressed at the meeting, as to the part that the proposed commission might play in inquiring into the wide differences between the early and the later decisions of the Supreme Court, is an excellent one.

WITH this last issue of the year we chronicle an addition to the already remarkably numerous and significant advances which have this year been made in the domain of thermo-electricity. With one year's work before us showing such progress, it cannot be doubted that before many years have elapsed we shall have the direct conversion of the energy of coal into electricity as an accomplished commercial success. Beginning with the experiments of Hinghausen and Nerust, the fact is brought out that if a thin slip of metal be placed in a magnetic field with its ends at different temperatures a difference of potential is set up between the two opposite sides of the metal slip. This experiment, somewhat analogous to that of Hall's phenomenon, has, though interesting, attracted little attention on account of the minuteness of the currents so generated, but the developments in another direction have opened a wide field for invention and speculation. We refer to the pyromagnetic generator of Edison and the electric furnace generator of Berliner. Both these inventors have called to their aid the well known property of iron, in virtue of which it loses its magnetism when heated. While these apparatus have not yet been reduced to commercial forms, the principle involved in their operation appears to be open to considerable development, and the coming year will in all probability find not a few individuals at work upon the same idea. But not less interesting than the preceding is the apparatus described in another column, in which the difference of potential created between two metallic pieces at different temperatures is utilized as a working principle. This method is an old one, and forms the basis of the thermopile. In the latter, as usually constructed, however, two dissimilar metals are employed, while in the apparatus described only one kind of metal is used. This in itself is also not new, but Mr. Acheson's aim has been to create as great a difference of temperature as possible between the two electrodes placed as close as possible. It will be noticed that in one form of his apparatus Mr. Acheson employs water as the medium, which acts first as a good conductor of electricity, and secondly as a bad conductor of heat—the conditions which are here most desirable. But it may at first sight appear anomalous that in a second form of apparatus the inventor should employ a gas as a medium between the plates. A little further consideration, however, will show that this is by no means the case. Gases are known to be bad conductors of heat and good insulators of electricity, when cold. But when heated their conductivity for the electric current is greatly increased, and at a red heat they conduct electricity quite freely. This was first pointed out by Becquerel, and is exemplified in the function of the electric arc. In addition to this Blondlot has lately shown that the gas arising from an incandescent body, and having a temperature of only 70 deg. F., conducts for the very lowest E. M. F.'s, such as the one-thousandth of a volt. In the latter case, the current is probably conducted by minute threads of hot gas within the surrounding cooler part. It will thus be evident that under these conditions a gas may be advantageously employed as a conductor. We are not informed of the E. M. F. or efficiency obtainable with the arrangement described, but it would seem specially adapted to the utilization of the waste heat of furnace gases.

NEW BOOKS.

FORTSCHRITTE DER ELEKTROTECHNIK: A QUARTERLY REPORT OF ELECTRICAL PROGRESS. Edited by Dr. Karl Strecker with the assistance of Dr. M. Kiliani and Dr. E. Pirani. Parts I. and II. for 1887. Berlin, 1888: Julius Springer, 396 pp. 6 × 9 in. Price, $3.60.

It is not frequently that we feel called upon to direct special attention to the great merit of any particular, new electrical work; but we would fall short of our duty if we refrained from bestowing upon the volume before us the full measure of warm encomium which it deserves.

In spite of the number of electrical works now appearing in rapid succession, the fact remains that the electrician of to-day looks largely to the periodical press for information to guide him in his daily work. But to keep up with this in all the various branches now developing might well occupy the entire attention of any one man. Hence a ready means of ascertaining the principal contents of periodicals devoted to electricity and kindred branches must be of great value to the student, as well as to the practical worker.

It is this task of indexing the entire electrical literature contained in current periodicals that the editors of this work have performed in a most skiliful manner, and with a thoroughness that commands admiration. The volume before us embodies a complete classified index of articles on electrical subjects that have appeared in no less than seventy-three periodicals in the English, German, French and Italian languages during the period of the first two quarters of the current year.

The simple indexing and classification would in itself be a work of great labor and value, but when to this we add the fact that nearly every reference is accompanied by a note explanatory of the contents and varying in length from a few lines to several pages, the immense amount of work embodied here will be apparent.

The plan of the work is admirably adapted to facilitate the hunting up of any reference. The subjects are classified under the various heads and sub-heads, and each reference is numbered consecutively. At the end of the simple index, under each head, these reference numbers are repeated in small type placed in the margin, and in this place the contents of the article referred to are given with greater or less detail, as the importance of the subject calls for. Marginal notes even here serve to make the work of the searcher more easy.

As stated above, seventy-three periodicals have been indexed, and every article is traced through the entire number of periodicals in which it appears. Thus, in one instance, no less than twenty-five references to the same article are given in periodicals published in four different languages. Each reference is, in addition, accompanied by a note regarding the length of the article, and, as a rule, the original source of the article is given first among the references. In the case above mentioned, in which one article was republished in no fewer than twenty-four periodicals, THE ELECTRICAL WORLD is correctly given as the original source. The subject matter was Prof. Elihu Thomson's electric welding. Each reference contains the name of the periodical, the number of the volume and page in which it appears, and the number of illustrations, if any, accompanying it. It is also worthy of note that the more important United States, English, German and French patents are indexed, and the end of each volume will contain a list of the electrical works published during the year.

In a work of such uniform excellence as this it would seem almost invidious to dwell upon a shortcoming. But if we may be allowed to suggest an improvement it would be, that to each reference be added the date of the periodical referred to. It is true that each volume of the index embraces one year, but it is frequently more desirable and convenient to hunt up references by the day of the month instead of by the number of the volume of a periodical.

The editors of this index deserve the thanks of the entire electrical community, and we hope they will continue their work with the thoroughess exhibited in the volume before us. We are glad to know that in this country the beginnings have been made of similar work by the body within whose province it lies.

THE MODERN SERVICE OF COMMERCIAL AND RAILWAY TELEGRAPHY, INCLUDING THE RAILWAY STATION AND EXPRESS SERVICE. ARRANGED IN QUESTIONS AND ANSWERS. Sixth Edition. Revised and enlarged. By J. P. Abernethy. New York. 1887. W. J. Johnston. 423 pp. Price, $2.00.

This work is so well known that any extended review seems hardly necessary, and yet it is gratifying to note that, old as the art of telegraphy is, it has given rise to sufficient new matter within the last few years to call for another revision and enlargement of this work. The volume begins with a series of instructions for beginners and notes on the nature of the Morse system of telegraph, which is followed by a short treatise on electricity and magnetism generally, sufficient to give the learner a knowledge of the scientific principles involved in his daily work. This is followed by a description of the circuits and apparatus and office equipment generally, and includes the various methods of working duplex, quadruplex, etc., as well as the testing for faults. All that which is embodied under the above head relates to the electrical service pure and simple. But not the least important part of the operator's work is other than electrical, and claims his attention in an equal degree. In this is included the management of the telegraph office, the method of receiving and transmitting and delivering messages, and in general the clerical work of a commercial telegraph office. All these points are fully treated of in the fourth part of the book, in which commercial business is the subject.

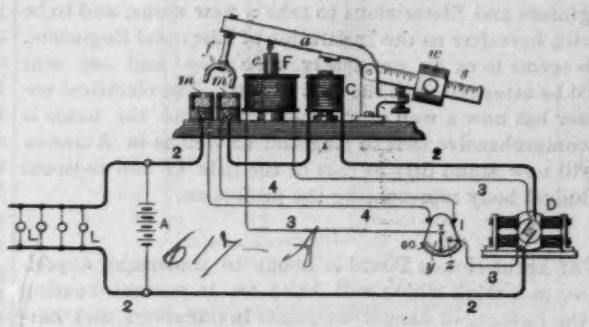
But while a city office is quite exacting in the nature of its work, a railway telegraph office frequently calls for the highest skill and judgment, and, considering the large number of single-track railroads in this country, the small number of railway accidents due to the telegraph speaks well for the intelligence of those engaged in operating it. This part of the service is freely dealt with in the work in which the train dispatcher's and operator's duties are fully set forth. As the railway station operator frequently discharges the duties of both passenger and freight agent, the work very properly includes a complete description of these duties.

The book, for the most part, takes the form of a catechism, being a series of questions and answers—an excellent method of imparting knowledge. The volume is well printed, and illustrated wherever necessary, and as the work of a railway telegraph superintendent is eminently practical in all its bearings.

Automatic Switch for Secondary Batteries.

In the operation of storage batteries it is necessary to take precautions which shall prevent the batteries being discharged through the dynamo, and for this purpose care must be taken not to throw the batteries into circuit before the machine has reached the proper E. M. F. for charging. In order to perform this work automatically, Mr. W. W. Griscom has designed the automatic circuit-closer shown in the accompanying illustration.

As will be seen, the dynamo and accumulators are connected in circuit 2, but a separate circuit of high resistance 3 from the poles of the dynamo includes the electro-magnet *F*. The armature *c* is fixed to the pivoted lever *a*, having a gravity retractor *w* moving over a graduated scale *s*. This adapts it for use as a current-measuring



AUTOMATIC SWITCH FOR SECONDARY BATTERIES.

instrument, in which case the mercury cups are connected temporarily by a switch.

C is a coarse wire coil permanently in the main circuit, the armature of which is also fixed to the lever *a*. A switch, consisting of mercury cups *m m'* and fork *f*, dipping into both *m* and *m'*, is arranged to operate in the main circuit 2 under control of lever *a*. A polarized electro-magnet of high resistance *I*, which may act as a voltmeter, is connected in a circuit, joining the mercury cups *m m'*. The magnet *I* operates the contact points *y* in the circuit 3, which contains the magnet *F*.

The operation of the apparatus is as follows: When the dynamo and battery are first connected together, the apparatus is in the position shown, except that the needle of *I* will indicate the electromotive force of the battery, taking up a position toward the point 60. As the dynamo starts into operation its electromotive force gradually rises until it overcomes that due to the charge remaining in the battery, bringing the needle toward zero. The fixed contact *z* is in a position beyond zero, toward which the needle or contact *y* will be carried by the electromotive force due to the dynamo; and when the electromotive force reaches a predetermined point above that of the battery, and in the opposite direction, contact between *z* and *y* is made, closing the circuit 3. Current then flows from the dynamo through circuit 3. The solenoid *F* is then energized and attracts its core *c*, drawing down lever *a* until fork *f* enters mercury cups *m m'*. This closes the main circuit, energizing magnet *C*, which attracts its armature and holds the lever *a* in the position to which it was brought by the magnet *F*. The closing of switch *f m*, however, has cut out circuit 4, thus allowing points *z y* to separate and open circuit 3. The magnet *C* now carries the entire current, and should the effective strength of current from the dynamo fall to a point where magnet *C* would be insufficiently excited to hold lever *a*, the points will immediately assume their normal position, as shown in the illustration. The introduction of the high-resistance circuit 4 avoids any possible injury to the dynamo by reason of the return current.

Some Facts Regarding Wires for Resistance Coils.

BY PROF. W. A. ANTHONY.

It has often been pointed out that, for safety against heating in wires conveying electric currents, those having a high conductivity have the advantage over those of low conductivity. But the idea, that in order to get a given resistance into a small space it is necessary to use material having high specific resistance, appears to be so prevalent, that it seems worth while to again point out the fact first mentioned. Indeed it seems to be one of those things that has become so completely settled into the mind of most people who have to do with resistance wires, that it may have to be repeated again and again before it will come to be an accepted fact.

I find, for instance, that in the manufacture of resistance boxes for the control of dynamo electric machines, German silver wire is almost universally used, with the idea, as I find upon inquiry, that a wire having a high specific resistance can be put into a smaller space with immunity against heating. I find, too, that the idea is prevalent that for the manufacture of resistance coils for measurements, it is desirable to obtain a German silver or a composition of the highest possible specific resistance. Of course, for the making of very high resistances, such as 100,000 ohms, or more, it is important to use a material of high specific resistance, because otherwise the wires we should have to use would be too small for ready manipulation; but when the wire used would be larger than No. 33 or 32, the advantage is in favor of an alloy of low specific resistance rather than a high one. But, in the manufacture of resistance coils for the purposes of measurement, the thing of paramount importance is evidently a low temperature co-efficient, in order that the resistance may change as little as possible for the changes of temperature to which the coils will always be subject in use.

The fact that a coil of wire of high specific resistance has no advantage over one of low specific resistance will appear from this simple consideration. Let us suppose two coils, one of copper and the other of German silver, of the same resistance and same size, to be wound upon the same bobbin, and each using the same weight of wire. The copper wire would, of course, be smaller in diameter and longer than the German silver; but being of the same resistance, a given current in the former will generate the same amount of heat; and since there is the same surface of exposure, there will be precisely the same final temperature, provided the current continued long enough for the temperature to reach a stationary point. In the use of resistance coils, however, where the currents are kept upon the coil only for a short time, the question would be one of *rate* of rise of temperature, and in this regard the wire of lower specific heat would rise in temperature more slowly.

When it comes to the use of wires which are wholly exposed, either stretched out as line wire carrying electric currents, or coiled in loose spirals, as is often the case for resistances in resistance boxes for controlling dynamo electric machines, it can easily be shown that the lower the specific resistance the less will be the space which the resistance will occupy, and the less will be the weight of material necessary to be used.

Let *K*, *L* and *D* represent respectively the specific resistance, the length and diameter of a wire of one material, and the corresponding small letters *k*, *l*, *d*, represent the same quantities for the wire of another material. If we assume that the two wires have the same resistance, then, for a given current the same amount of heat would be generated in both; and if both are to come to the same temperature they must have the same surface exposed for the escape of the heat. The resistance may be expressed as follows:

$$R = \frac{K L}{D^2} = \frac{k l}{d^2}. \qquad (1)$$

Assuming the surfaces to be the same, we have:

$$S = \pi L D = \pi l d. \qquad (2)$$

The volumes will be, respectively:

$$V = \tfrac{1}{4} \pi L D^2; \; v = \tfrac{1}{4} \pi l d^2. \qquad (3)$$

From (1) we have:

$$\frac{K}{k} = \frac{l}{L} \times \frac{D^2}{d^2}.$$

From (2) we have:

$$\frac{l}{L} = \frac{D}{d}.$$

Hence,

$$\frac{K}{k} = \frac{D^3}{d^3} = \frac{l^3}{L^3};$$

From (3):

$$\frac{V}{v} = \frac{L}{l} \times \frac{D^2}{d^2} = \frac{k^{\frac{1}{3}}}{K^{\frac{1}{3}}} \times \frac{K^{\frac{2}{3}}}{k^{\frac{2}{3}}};$$

or,

$$\frac{V}{v} = \frac{K^{\frac{1}{3}}}{k^{\frac{1}{3}}}.$$

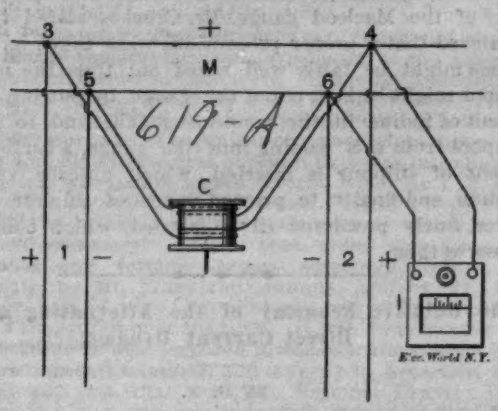
That is, the ratio of the volumes of the two wires is the same as the ratio of the cube roots of their specific resistances.

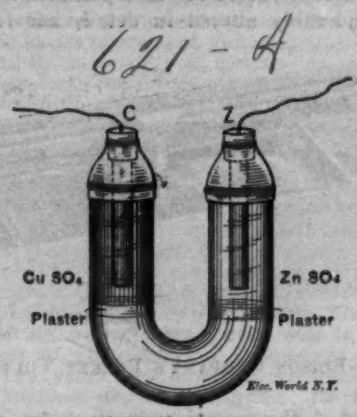
Now, taking the case already mentioned, namely, the resistance boxes for the control of dynamo electric machines, let us suppose that we use copper wire in the place of German silver. Since the specific resistance of German silver is about twelve times that of copper, the *volume* of German silver required would be about two and one-quarter times as great; and, since the densities of the two metals are not very different, we may state roughly,

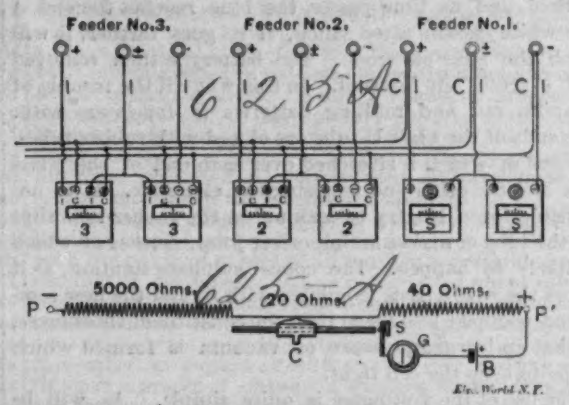
that, to make the resistances of German silver with the same degree of *safety as to heating*, it would take *twice the weight* of German silver as of copper.

There is another fact, too, which has been several times pointed out before, but it seems to take a long time to become an accepted fact with men who are continually dealing with resistance wires, and that is, that a covered wire, at least up to any of the sizes ordinarily used, will give out the heat generated in it by the current more rapidly than a naked wire of the same size; or, in other words, that for the same current, a covered wire will be cooler than a naked one of the same size. This is a fact that has been demonstrated theoretically, and been shown to be true again and again by experiment. But most people seem to consider that a wire is like a steam pipe, and that the covering on the outside of the wire would have the same effect as the covering on a steam pipe in keeping heat in it. The difference in the two cases lies in the relative diameters; the covering which is put upon the wire exposes a much larger surface than the wire itself, and is a better radiator; and as it comes into intimate contact with the surface of the wire it carries away the heat and diffuses it into the atmosphere more rapidly than it can escape from the bare surface of the wire.

I do not call attention to these facts as being new, but as something upon which almost every one who has to do with electrical conductors has an erroneous idea, and it seems to me worth while that attention should be called to these points; in fact, it would seem to be worth while to call attention to them again and again, until the facts come to be accepted.







FIGS. 9, 14, 10 AND 12.—INDICATING INSTRUMENTS OF THE EDISON ELECTRIC LIGHT COMPANY.

The Indicating Instruments of the Edison Company.

II.

In distributing currents at constant E. M. F., it is necessary to maintain the same pressure at the ends of all the feeders, and this may be accomplished by connecting a pressure indicator to each side of each feeder end and regulating each point by reference to these pressure indicators. This method, in a three-wire system, evidently requires twice as many pressure indicators as there are feeders, each one of which has to be kept in adjustment. The same result, however, may be accomplished by maintaining the desired pressure at the end of one feeder by reference to pressure indicators, and at the other feeder ends by reference to comparative indicators. The advantage of this method is that the two pressure indicators only need to be kept in adjustment; the comparative indicators, being once set up, require practically no attention.

Our illustration, Fig. 8, shows in perspective the comparative indicator used for this purpose, and Fig. 9 is a diagram showing the principle upon which the same operates. In the diagram *M* is the distributing circuit, and 1 and 2 are feeding circuits. At the point where feeding circuit No. 2 joins the distributing circuit, a pressure indicator *I* is connected, by reference to which the pressure at that point is kept at the desired standard. *C* is a differential galvanometer, or "comparative indicator," connected as shown, one coil being joined to points 3 and 4 and the other to 5 and 6. If now the points 3 and 4 be at the same potential and the points 5 and 6 to be also at the same potential, then the difference of potentials or pressures at the end of feeder No. 1 is the same as at the end of feeder No. 2. No current will flow from 3 to 4, nor from 5 to 6, and the galvanometer *C* will remain at zero. Again, if the point 5 be at the same potential as the point 6, but the point 3 be at a different potential from the point 4, there will then be a current in the coil connected between 3 and 4, and the galvanometer will show a deflection one way or the other, depending on whether point 3 is higher or lower than the point 4. Under these conditions *C* would give a deflection, as the pressure at end of feeder No. 1 is not the same as at the end of feeder No. 2. If, now, the + wire of feeder No. 1 be adjusted until 3 is at the same potential as 4, *C* will come to zero, for then the pressures at ends of No. 1 and No. 2 are equal. Instead of adjusting the + wire of feeder No. 1, the — wire of feeder No. 1 may be adjusted to bring the galvanometer *C* to zero. When *C* is brought to zero in this way the point 5 is made just as much higher or lower than 6 as 3 is higher or lower than 4. There are then currents in both coils of the galvanometer *C*, but they will be equal and balance each other and *C* will remain on zero, as it should, since the difference of potentials or pressure at the two feeder ends is the same.

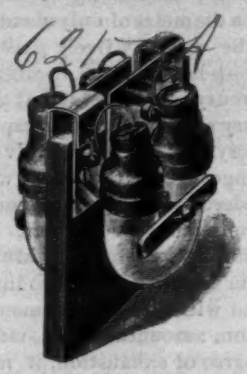


FIG. 13.

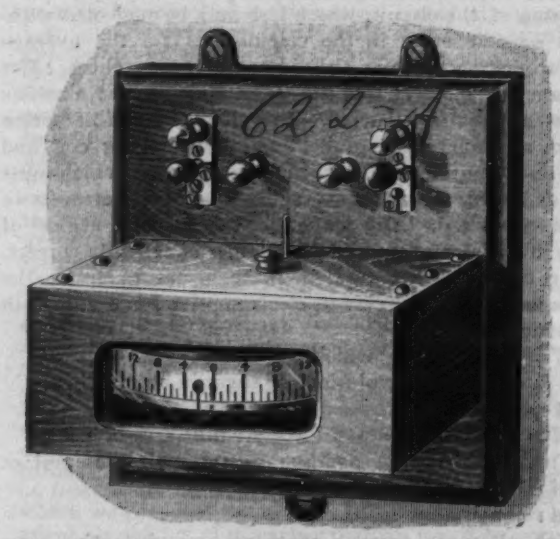
The diagram, Fig. 10, shows the manner in which the comparative indicator is applied. There are here shown the pressure wires from three feeders; No. 1, the standard feeder, and two others. From each feeder a set of iron pressure wires is run; these are marked *I I*, and the points on the comparative indicators to which they are connected are also marked *I*. From the end of feeder No. 1 an extra set of pressure wires is run; these are of copper wire and run to all the comparative instruments, as shown, being connected to the points marked *C*. This is the manner in which the comparative instruments are connected in all three wire systems, except that in some systems only one set of pressure wires is used on No. 1 feeder. When connected as shown, the pressure at the ends of feeders Nos. 2 and 3 is compared with the pressure at end of feeder No. 1, and when all the comparative indicators are at zero, the pressure at the ends of all three feeders is the same.

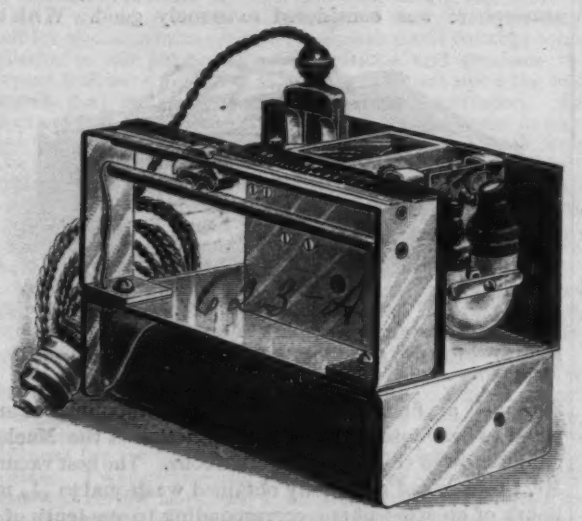
All the instruments thus far described are designed to remain permanently in position, but it is frequently desirable to measure the potential at various points in a circuit, since the indicators at the station gives the pressure at the feeder ends only. For this purpose the voltmeter, illustrated in Fig. 11, is employed, the engraving showing the instrument removed from its case in which it can be readily carried about from place to place.

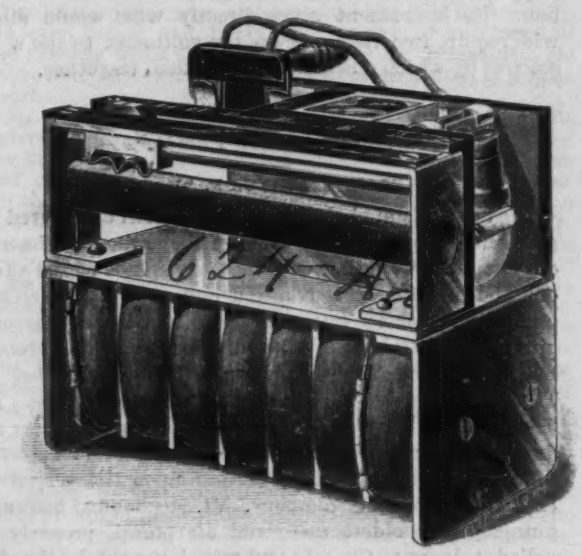
The operation of this instrument is based on the well-known "potentiometer" or "opposition" method of measurement.

The voltmeter contains a small Daniell cell of known constant E. M. F. The E. M. F. of this cell is opposed to the E. M. F. in a part of the voltmeter circuit, and this part can be varied by moving a sliding contact, to which one terminal of the battery is connected, along a resistance forming part of the voltmeter circuit. When the E. M. F. in this part of the voltmeter circuit around which the battery is connected is equal to the E. M, F. of the battery circuit to which it is opposed, no current will flow in the latter, and the galvanometer which is included in it will show no deflection.

The diagram, Fig. 12, shows the circuit connection of the instrument. *P P'* are the terminals to which the circuit to be measured is connected; *B* is the battery of known E. M. F.; *G*, a galvanometer; *C*, a contact that is adjustable along a resistance of 20 ohms; *S*, a switch closing the circuit from *P'* through the battery and galvanometer to the contact *C*. We will assume that the circuit is closed from *P'* through *B*, *G*, *C*, part of the 20 ohms, and the 40 ohms back to *P'*. We will also assume that the positive pole of the battery and the positive pole of the circuit to be measured are both connected to *P'* and that a current is flowing from *P'* to *P*. Then, in this closed circuit, two electromotive forces exist which tend to set up currents in opposite directions through battery *B* and galvanometer *G*. The battery tends to send a current through *G* from left to right, and the E. M. F. of the circuit itself tends to make a current pass from *P'* to *C* through *G*; *i. e.*, from right to left. Hence, when the E. M. F. from *P'* to *C* is equal to the E. M. F. of the battery, no current will flow in *G*, as the two equal







FIGS. 8, 11 AND 14.—INDICATING INSTRUMENTS OF THE EDISON ELECTRIC LIGHT COMPANY.

E. M. F.'s are opposed to each other, and thus prevent a current from flowing in the galvanometer circuit. Knowing now the E. M. F. of the battery, and the value of the resistances, it is only necessary to know the position of *C* along the 20 ohms to determine the E. M. F. acting from *P'* to *P*, which is the quantity we wish to measure. The volmeter is provided with two standard cells, shown separately in Fig. 13, and which can be readily removed for renewal when necessary. By simple sliding connections shown at the top these may be arranged either in multiple or in series. When the cells are in multiple the pressure necessary to balance the instrument is read directly off the scale in volts; when placed in series the pressure required to balance the instrument is given by doubling the scale

reading. The scale usually reads from 90 to 130; with the batteries in series it reads from 180 to 260 volts.

The standard cell employed is shown in detail in Fig. 14. It is a portable air tight Daniell cell, in which it is impossible for the copper sulphate to come in contact with the zinc electrode for three or four months, and during this time the slow progress of the copper sulphate toward the zinc electrode is plainly visible. The cell consists of a U-tube, the bend being filled with a paste. In each leg of the tube is placed respectively a rod of copper and zinc dipping into the sulphate solution of the same metal.

The blue copper sulphate colors the whole paste as it advances; the line between the blue and white is plainly marked, and, as time passes, the blue reaches the end of the white paste, after which, if it goes farther, it will reach the zinc electrode. The battery is then removed and a fresh one inserted. In this way all the trouble of cleaning out and refilling batteries is done away with. The ends of the glass U-tube are closed with rubber tubes, one end of which is stretched over each end of the glass tube and the other end inclosing the electrode. It is impossible for a battery to leak unless the rubber tube slips off the tube or makes an imperfect joint, neither of which is likely to happen. The copper sulphate solution, as it colors the whole paste, combines with it, and the new compound occupies less space than the constituent substances, so that an inward pressure or vacuum is formed which helps to keep the cell tight.

The use of the voltmeter is quite simple. As will be seen in Fig. 11, a plug is inserted between two contacts, and is connected by flexible cords to another plug, which is inserted into the lamp socket at the point it is desired to test the E. M. F. of. The variable resistance is mounted on a spool, and the sliding contact moves along a scale marked to read volts. When upon the depression of the key beside the galvanometer the latter shows no deflection the number of volts can be read directly off the scale.

The principal use of the voltmeter is to determine the pressure *at the lamps* in different parts of the circuit. In central stations a constant pressure is maintained at the feeder ends; the voltmeter enables one to determine just what the pressure is at any point of the circuit. Points distant from the feeder ends necessarily have a lower pressure than the latter, and by means of the voltmeter the exact difference can be determined, and if the difference is too great its cause can be looked for and remedied. Another use for the voltmeter is to measure the loss on pressure wires carrying the indicator currents to the central station.

In the Edison municipal system of incandescent lighting the lamps are placed in series, and the current is kept constant, the E. M. F. varying with the number of lamps in circuit. For measuring the E. M. F., the voltmeter shown in Fig. 15 is employed. The principle of its construction is identical with that of the instrument just described, but special precautions are taken to obtain high insulation, and all parts which come in contact with the hand are made of ebonite instead of metal, as in the former.

An instrument also designed on the same principle and arranged to be carried in the pocket is shown in Fig. 16. It measures 6¼ × 3¼ × 1¼ inches, and is very convenient for inspectors' use.

Another convenient instrument for the inspectors' use is the pocket balance indicator, Fig. 17, which is used for determining the balance at any part of a three-wire system. The instrument gives directly what would otherwise require two readings on the voltmeter to show the amount by which one side is higher than the other.

Mercurial Air Pumps.*

BY PROF. SYLVANUS P. THOMPSON.

The author stated that in 1643 Torricelli discovered the possibility of producing a vacuum above the top of a mercury column, by filling with mercury a tube closed at one end and then inverting it into a cup containing mercury, and this discovery forms the basis of all true mercurial air pumps. These may be divided into six classes: I. Those which drive the air up a barometric tube. II. Those which drive the air down a barometric tube. III. Those which drive the air up one barometric tube and down another. IV. Combination pumps. V. Injection pumps dependent in their action upon the velocity of efflux of a stream of mercury. VI. Mechanical mercurial pumps. The oldest mercurial air pump, properly so-called, belongs to Class I., and was invented by Swedenborg before 1722. The apparatus consisted of a table standing on three legs, and into the top of this is let a brass plate, forming a stand for the receiver from which it is desired to exhaust the air. In the plate are two holes, one of which is closed by a tap, and is simply designed to allow air to enter the receiver when the experiment is finished, but the other communicates through a valve opening downward with a conical iron vessel placed beneath the top of the table. This vessel is provided with another valve opening upward and which communicates with the outer air. The lower end of the above-mentioned vessel ends in a flexible leather tube, to which is adapted a piece of iron tubing ending in an open mouthpiece, which can be alternately raised and lowered. To work the pump, mercury is poured into the mouthpiece, which is raised till the mercury completely fills the conical vessel previously mentioned, driving the air contained therein through the valve communicating with the atmosphere. If the mouthpiece is now lowered, the mercury in the cone will fall, and air will pass from the receiver into the space thus left, and on again raising the mouthpiece will, by the rising of the mercury, be driven out into the outer air. By repeating the process several times a fairly good vacuum could be obtained. Since Swedenborg's time great improvements in detail have been made by various experimenters, amongst whom must be mentioned Geissler, of Bonn, who constructed his first pump in 1855, which, though considerably altered in detail, has formed the

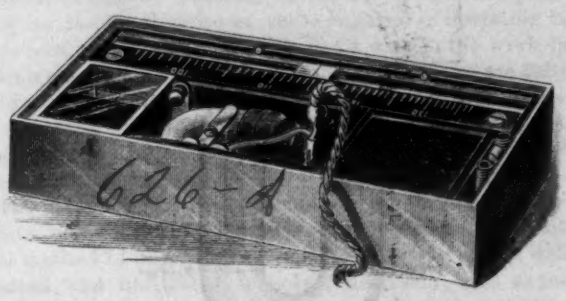


FIG. 16.—EDISON COMPANY'S POCKET VOLTMETER.

basis of most of the pumps now used for exhausting glow lamps. In 1864 Prof. Robinson suggested that the pump might be shortened by partially exhausting the air from the surface of the mercury in the supply vessel, and this device has been adopted in most of the pumps at present in use. In 1881 Schuller described two very ingenious forms of valve. In one of these the pipe leading to the pump-head was made by fusing a piece of tubing, which had been drawn down to a conical point, into another piece of tube, so that the passage through the tube was contracted at the tip of the cone, leaving an aperture having a diameter of only about three millimetres. Through this the mercury freely passes on its upward path to the pump-head, but on coming down again the last drops of mercury remain behind at this spot, and form, owing to capillary attraction, a little cap over the tip of the cone, giving a very perfect form of valve. The autotype of Class II. is Sprengel's air pump, which was devised in 1865, and has since undergone great improvements at the hands of Crookes, Gimingham and others, and a method of working this pump at a high temperature was devised by Professor Rood in America, who also introduced a bend in the fall pipe, and with this arrangement claims to have obtained a vacuum amounting to $\frac{1}{300}$ millionth of an atmosphere. The degree of exhaustion, it may be remarked, is measured by a Macleod gauge, which was invented in 1874, and depends on the principle of compressing a known volume of the rarefied air into a smaller space, which is then measured. The other classes of pump, though interesting from a scientific point of view, do not appear to have come into much practical use, and we will, therefore, not refer to them further. In all rather more than forty different forms of pump were mentioned by Professor Thompson. At the close of the paper the chairman, Mr. William Crookes, F. R. S., observed that opinions as to what constituted a perfect vacuum had greatly altered since the days of the old mechanical pump, with which instrument an exhaustion down to $\frac{1}{760}$th of an atmosphere was considered extremely good. With the

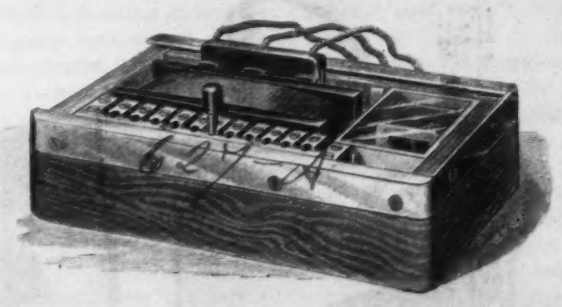


FIG. 17.—EDISON COMPANY'S POCKET BALANCE INDICATOR.

Sprengel as first introduced a perfect vacuum was supposed to be obtained, but the introduction of the Macleod gauge showed this idea to be erroneous. The best vacuum Mr. Crookes had personally obtained was equal to $\frac{1}{100}$ millionth of an atmosphere, corresponding to one-tenth of an inch on a barometer 200 miles high, but even at this pressure there would be 10 billion molecules in a cubic centimetre of air.

The discussion was opened by Mr. J. Swinburne, who preferred the long pumps to the shortened ones, as it was very difficult to preserve the partial vacuum above the mercury in the reservoir. He doubted the accuracy of the Macleod gauge, as Regnault had, he believed, stated that the vapor pressure of mercury was about 51 millionths of an atmosphere at ordinary temperature. The Geissler pump he had found to give more perfect vacuums than the Sprengel, and he therefore preferred it. In answer to a question from Professor Thompson, he might state that he had found silicate of soda made a very good cement for making air-tight connections.

After a few remarks from Professor Ramsey, who has also investigated the vapor density of mercury, and shown that Regnault's results are very inaccurate, Mr. Vernon Boys stated that he had found the improvements in the Sprengel pump, mentioned in the paper as having been introduced by Professor Rood, of the utmost value, as the heating seemed to make the mercury stick close to the glass, whilst the crook in the fall pipe did away with the hammering of the mercury.

In replying to the discussion, Professor Thompson stated that the advantage of the shortened pumps was that the air clung less closely to the mercury, and a better result can therefore be attained.

Referring to Mr. Swinburne's remarks as to the inaccuracy of the Macleod gauge, Mr. Crookes stated that he believed that if proper precautions were taken its indications might be fairly well relied on; thus the mercury vapor might be kept out of the gauge by putting a fragment of iodine in the connecting tube, and to prevent vapors from this passing into the gauge, a further fragment of sulphur is inserted, which absorbs vapor of iodine, and finally, to prevent vapors of sulphur passing over, finely powdered silver is used, which completely absorbs them.

The Relative Economy of the Alternating and the Direct Current Dynamo.

BY G. N.

In the paper read by Mr. Wm. Stanley, Jr., before the American Institute of Electrical Engineers, the author draws a comparison between the efficiency of the continuous and alternate current machines, and he finally awards the palm to the alternate current machine. Primarily, however, he shows that the two kinds of machines are equal in economy by means of the following statements as to the output of each:

Direct current machines: x volts; R ohms; A ampères. Alternating current: $2x$ volts; $4R$ ohms; $\frac{1}{4}A$ ampères. Now, the above statements rest solely upon the assumption that the coils in the alternate current machine are all connected in series, in which case alone the E. M. F. generated would be $2x$ volts, as compared with x volts in the direct current machine, in regard to which latter the necessary presumption exists that half the coils are constantly in parallel arc with the other half. For the alternating current generator the average value of the E. M. F. generator would only be $2x$ *under like conditions* in the particular case, evidently assumed, that all the armature coils are connected in series. The rest follows as a matter of course, as n coils connected in parallel arc with n similar coils offer one-quarter the resistance of n coils connected to n similar coils in series. The resultant deductions would be true only upon the assumption of like conditions for both.

These conditions, however, do not exist in practice, and regarded simply as mathematics, the statements are also open to criticism. It is evident that, so far as the work performed in generating E. M. F., that is, the rate of cutting lines of force, is concerned, the average result is identical for the two types of machine, as the mere adaptation of a commulator for the rectification of reversed currents has no effect upon the resultant values. But the E. M. F., and consequently the current generated in the alternating machine, is the direct result of two factors, namely, the rate of cutting lines of force and the self induction of the circuit, which last may be neglected without sensible error in the calculations for the average electromotive force in the direct current machine. But it cannot be neglected in the alternating current machine as at present constructed. The effects of self induction react at each change of field upon the moving coil, and the resultant effect is a subtractive quantity which must be deducted from the average amount of electromotive force generated. Any deductions based upon a neglect of this important factor cannot be mathematically correct. Were there no self induction in the armature circuit, the expression for the average electromotive force E in both machines would be:

$E = 4\,n\,A\,H$. In which

n = number of revolutions or turns in unit of time.

A = equivalent area of armature coil.

H = number of lines of force per unit area of field.

The above is the average value of the integral of $-\frac{d\,n}{d\,t} = E$.

For alternate current machines a subtractive term enters, which depends upon the self induction of the circuit.

For the latter machine we have:

$$E = -\frac{d\,n}{d\,t} = -\frac{d(A\,H\cos\phi + Li)}{d\,t};$$

which reduces to $$E = \frac{2\,\pi\,A\,H}{T}\sin\frac{2\,\pi\,t}{T} - L\frac{d\,i}{d\,t}$$

in which is introduced a subtraction term which depends upon the self induction of the circuit, and is a function of the current flowing, i. Neglecting this term, the value of E reduces to:

$$E = 2\,\pi\,n\,A\,H\sin\phi,$$

for which the average value is $4\,n\,A\,H$, as before.

As regards the Westinghouse machine, a further error is introduced in the assumption that the coils are all in

* Abstract of paper read before Society of Arts, November, 1887.

series. Illustrations of the machine all show them connected in single multiple arc, which, so far as the equations for the E. M. F. are concerned, would simply have the effect of reducing any such machine to the form of one having half the number of fields.

Discussion of Patent Law Revision.

The presentation of Mr. Arthur Steuart's weighty paper on "Revision of the Patent Law," before the American Institute of Electrical Engineers, on Dec. 20, brought out a very valuable discussion and correspondence, of which a résumé will be found below:

The PRESIDENT: This subject is one, I may say, that lies well within the province and jurisdiction of the American Institute of Electrical Engineers. It has been brought before us on various occasions, and it is somewhat interesting to recall the fact that at our very first meeting, held in this room for purposes of organization, now close upon four years ago, almost the first question that was introduced to our notice was that of patent reform, when Mr. C. J. Kintner, of the Patent Office, addressed a spirited appeal to us for aid in bringing about certain reforms which he then deemed necessary. Since that time we have had valuable and forcible papers presented before the Institute by Mr. Frankland Jannus, and by Mr. A. C. Fowler, both of whom brought out very ably the necessities of the situation at the time. It will thus be seen that the Institute is well prepared to consider the subject in all its bearings and relations, and is ready to ascertain from Mr. Steuart just what work the National Electric Light Association now proposes to do with regard to this bill to be laid before Congress. I may say here that I have myself had the opportunity of attending all the meetings of the National Electric Light Association at which this question has been brought forward, and I think I may take the liberty of saying that that society does not intend to act with any undue haste or precipitancy in the matter, but is likely, in fact, is sure, to proceed with its accustomed practicality and business-like common sense. Our position to-night is one in which we may be able to do great good in the direction of showing how far this movement is calculated to receive the support and sympathy of scientific and professional circles, especially those that are connected withel ectrical interests.

Mr. GEORGE TICKNOR CURTIS, on the invitation of the President, addressed the meeting after Mr. Steuart's paper had been read, and detailed his own work in the matter of securing patent office reform, and mentioned an interview he had had in regard to it with Senator Platt, of Connecticut. He closed as follows: "It would take me half the night to touch all the points, or half of them, on which it seems to me the time has come for this kind of action My situation and occupation of late years have led me to bestow a great deal of attention on the course of the Supreme Court in the administration of the patent law. Unfortunately—I do not know how it has come about, exactly—but the present court has gone to very great lengths in overturning all the great doctrines of the patent law that were settled forty years ago when I first began to practice, and that is more than forty years ago. There have been decisions, which of course must stand as the law until Congress shall interfere and declare the law otherwise. Well, that is one great part of the task while such a commission would have to perform. They would have to examine all these cases and see whether they are or are not consistent with the fundamental principles of the law as it has been construed heretofore. The statute law is substantially the same to-day as it was when enacted in 1833. There has not been any very material change. But there is a very great departure in the doctrines that are held now by the Judges of the Supreme Court from what seemed to me to be the sound and true doctrines of the law, and I hope you gentlemen will go ahead and get your bill passed, and then secure as suitable a commission as you can. I have a copy of the bill of the last session, which I will hand to the President. I suppose that your bill, which in some respects is a better one, will go at once to the House Committee, and of all suggestions I should respectfully recommend that you avoid the appearance of aiming at any particular point, any particular change, in the present system of patent law more than others. The paper goes over a great deal of ground, specifies a great many different points. Well, there would be differences of opinion, of course, about those different matters. In a great deal of it I agree. I do not know whether I should agree with every part of it, but if you can present your application in such a way as not to allow the committee to have the idea that you have any axe to grind for yourselves or anybody else in respect to any specific question, why I think there is no doubt but what you will succeed in carrying the measure that you wish to.

The PRESIDENT: It has been very interesting indeed to have these remarks from a gentleman so well known and whose experience extends over a period of well nigh half a century. In listening to such mature advice and in governing ourselves by it, we certainly cannot do very far amiss. Mr. Curtis in his remarks made allusion to an interview that he had had with Senator Platt. I may state that a few days ago I wrote myself to Senator Platt, calling his attention to this movement which had been set on foot by the National Electric Light Association and which we proposed to bring within our purview, and I asked his opinion of it, saying that we would be very glad if possible to have his attendance at the meeting. I would like to read his reply. It is as follows:

"I have your letter of the 15th, expressing your desire that I be present at your meeting next Tuesday evening in New York. It will be impossible for me to leave Washington at that time.

"With regard to the proposed revision or amendment of our patent law, I can only say, generally, that while I think some amendments are very desirable, it is very doubtful, first, whether such amendments as are desirable can be obtained at the hands of Congress, and second, whether any attempt to radically amend our patent laws would not result in the passage of laws calculated to injure the interests of inventors and the public. I say this, because my observation leads me to believe that probably two-thirds of the Members of Congress are more or less prejudiced against patents and against certain desirable features of the patent system, and during all my experience in the Senate, it has been my effort to prevent Congress from passing laws which would be disastrous. No man can predict the outcome of an effort to amend the patent law. It may result in what we deem the advantage of the public. It is quite as likely to result injuriously to the public. I have been made to feel very many times that perhaps it was better to bear the ills we have than to fly to others we know not of. In saying this I do not mean to imply that I am not in favor of amendments, but simply to indicate the danger that always confronts us when we attempt to legislate with reference to patents.

"Very truly yours, O. H. PLATT."

We have, however, a representative of Connecticut with us in person this evening. I refer to Mr. Albert H. Walker, and his views on this subject would be likely to interest us very greatly.

Mr. WALKER: "I have listened with great pleasure, as we all have, to him whom we regard as the father of us all, speaking of ourselves as patent lawyers, or as interested in the development of the useful arts. The pamphlet that I see in the hands of some of you, and which I suppose has been read by most of you, contains an article by myself which sets forth the principal part of my views touching the desirability of revising the patent laws. It will therefore not be expected that I will elaborate my opinions upon the subject upon this occasion; but I shall be glad with your permission to make some observations touching the expediency of pressing them to revise those laws. I do not agree in the slightest with Senator Platt. My experience in the attempts that have been made to secure from Congress the revision of the patent laws, dates to a considerable period earlier than that of Senator Platt, and with all deference to him I think it has been more extensive than his has been, because during his occupancy of a seat in the Senate no such effort of any degree of seriousness has ever been made. Ten years ago now the celebrated bill 300 was before Congress—the 45th Congress. Its forerunner was before Congress eleven years ago—the 44th Congress—and very strenuous effort was made to pass that bill. Very large amounts of money were expended in employing distinguished lawyers to go to Congress and secure the passage of the bill. It was not at all favorable to the patent system as a science. It was advocated by men who had axes to grind. It was advocated by men of very great ability who had clients who contemplated plucking certain prospective prey of theirs, and it failed, because it was a bad bill, and I think that a bad bill can be relied upon to fail in the American Congress, upon the subject of the patent laws. A great many have failed, and I think they all will fail. Why? Because there are so many intelligent men in Congress, and because there are so many intelligent men in the United States who can explain things to the intelligent men who are in Congress. If we are ever going to make an effort to secure a revision of the patent laws, no time is more opportune than this. I read this afternoon on my way here from Hartford, an editorial published in the December number of the *Electrical Engineer*, taking the view of this subject which is taken by Senator Platt in his letter. The Senator indicated in that letter his opinion that a Congress which sits pending a presidential campaign and pending the counting of an electoral vote, is a very inopportune Congress to which to apply for a revision of the patent laws. But half of our Congresses come within that category. Half of your Congresses sit in the last half of a presidential administration, and the other half in the first half of a presidential administration, and those Congresses which sit in the last half of presidential administrations are generally understood to attend chiefly to presidential elections rather than to the public business; and for that reason the editor of the *Electrical Engineer* expressed the opinion that it is hopeless to expect anything in the way of important legislation from that Congress. I am inclined to agree with him, and therefore I advocate that that Congress be the Congress that be invited to pass the bill providing for a commission, and that the 51st Congress, which will not be trammeled by such considerations, be the Congress that be invited to enact the bill which shall be recommended by that commission. It is impracticable in my judgment to secure from any one Congress the passage of the bill to appoint a commission, and also the enactment of the legislation which may be recommended by that commission, because the time which passes after a particular Congress assembles and begins business before that Congress adjourns is less than fourteen months, and that time is too short a time in which to secure the passage of our bill or of any bill for the appointment of a commission and for that commission to pass through its deliberations and produce its report and have Congress to intelligently act upon the bill which may be recommended by that commission. In point of fact those three things never will be done in any one Congress. Therefore the obvious plan is to ask one Congress to appoint a commission or provide for the bill appointing a commission, and the succeeding Congress to pass upon the legislation that may be proposed by that commission, and that is the scheme of the bill which appears in your pamphlets as having been advocated by the National Electric Light Association."

Mr. Walker then went on to express his belief that the idea prevalent in some quarters as to hostility to patents was an exaggerated and even unfounded one. He had never met anybody opposed to the patent system.

Mr. CURTIS: I may give my friend from Connecticut a single instance such as he never met with. A great many years ago, before the war, there was a senator in Congress from North Carolina, Mr. Badger. He was a very eminent lawyer (general lawyer) and a most admirable person. I was conversing with him one day about a bill that was before Congress; I do not recollect whether it was a special bill or what, but it had relation to some changes in the patent law. "Well," he said, "all I know about the patent law is this. Some infernal Yankee comes down to my country and mouses around my back yard and looks over the fence and he sees something in use there in my garden, and he calls out to me and says, 'Stranger, I have got a patent on that; you will have to pay me ten dollars for the privilege of using it.' That," he said, "is all I know about the patent law, and all I want to know." "Well, I said, "Senator, you are here to legislate for the people of the United States; you are in the highest branch of the legislative department; now that is not worthy of you or of the State that you represent. Now, you just take this subject and look into it, and you will find that there is a great deal in it that you ought to know, and that you ought to be able to give an intelligent vote upon." He did so, and he was entirely convinced that he ought to know something more about the subject than he did. That is the only instance of the kind that I have met with.

Mr. G. M. PHELPS, JR.: I have a letter here from Mr. Kintner, which I will ask the Secretary to read, and after he has read it I will have a word or two to say:

The Secretary then read the following letter:

"Mr. GEORGE M. PHELPS:

"MY DEAR SIR: I am in receipt of a communication from Mr. R. W. Pope, Secretary of the American Institute of Electrical Engineers, advising me of the discussion touching the question of a revision of the patent laws on the 20th inst., and inviting me to be present and express my views in relation thereto. I had hoped that it would be possible for me to be with you upon this most interesting occasion, but business engagements will keep me in Washington the greater part of next week. This matter is of momentous interest to all inventors and persons interested in patent property.

"Some years ago I had the honor to call the attention of the society to the wants of the Patent Office and the necessities of material changes in the patent law. I have noted with interest all that has been done by the society, and am gratified at the fact that the committee appointed by it has succeeded in putting matters in a tangible shape to go before Congress. While the scheme proposed by this committee is, in my opinion, entirely practicable, I have some hesitancy as to the feasibility of its presentation to Congress at this time, and am in hearty accord with the views expressed by you in your editorial in the December number of the *Electrical Engineer*.

"During my official connection with the Patent Office as its chief clerk I very naturally became pretty well versed with the political phases of all matters appertaining to the conduct of the bureau. It is needless for me to say here that in matters of politics individual personal interests control individual members of Congress, and that upon the eve of a great national election such as occurs next November, we cannot afford to run the risk of losing everything in a proposed change of existing laws. I therefore beg that you will present the following resolution to the society and urge its passage:

"'*Resolved*, That it is the sense of this society that it is unwise at this time to seek by legislation to in any way modify the existing patent system, and that any movement to that end should be postponed until after Nov. 1, 1888."

"I am sure that this resolution will meet with the full approval of every one who has the good of the patent system at heart.

"Very respectfully yours, C. J. KINTNER."

Mr. PHELPS deprecated very forcibly any present action, and remarked: "I may say that if we could feel quite sure that the commission would be headed by Mr. Curtis, and composed of men like him and Mr. Steuart, we should have no hesitation as to their part of the work. The hesitation comes in as to what would be done with it after they had formulated it, and it seems to me we have little to expect from any very early Congress. The bills to reform other features of the national polity have not always fared very well at the hands of Congress. I do not know why I should feel so thoroughly certain of having a wise and discriminating action taken by that body upon a measure to reform the patent law."

Mr. A. C. FOWLER: "I have understood from good authority that three-fourths of the manufacturing interests of this country are based on patents, and I think that in the electric art we can safely say it is nine-tenths, because nearly every electrical appliance is patented in one way or another. Up to date there have been 375,000 patents and nearly 12,000 electrical patents, making one-thirtieth of the entire number of patents granted by the United States, electrical. Most of these electrical patents have been granted within the last ten or twelve years. There are about 25,000 applications patented every year—nearly that number—and about thirty thousand filed. In the electric art there are about 4,000 electrical applications a year, or about seventy-five per week, averaging about a dozen a day. I think this will show the importance of this subject to electrical men. That is the reason I mentioned it to-night. It would be safe to say that almost 10,000 of the 12,000 electrical patents that have been granted to date have been granted within the last ten or twelve years, averaging nearly a thousand electrical patents for each year during the last ten years."

Mr. Fowler then spoke warmly in defense of the patent office examining corps, and contended that if the examiners were better and fairly paid, many, if not most of the existing evils touched on would be remedied. He approved, however, the idea of establishing a patent court.

Mr. T. D. LOCKWOOD said that with all the evils of the patent law of the United States it is yet the best law of the kind in the world, and his experience was that it was not one-tenth as immoral as the patentees themselves. On the whole he was in favor of letting well enough alone and was very much of the opinion of Mr. Phelps and Mr. Kintner that at the present time it would be unwise to try to get any patent legislation.

Mr. F. JANNUS thought that while the patent law was good generally, there ought to be entire divorce between American applications and European ones. As to the recent International Convention, it was absolutely inoperative, because the American representative actually did not know the difference between the filing of an application and the granting of a patent. Mr. Jannus proceeded to touch on a variety of minor reforms necessary in the work done inside the Patent Office, in order to secure greater facility and accuracy of "references" and to insure greater uniformity of practice. These he thought would accomplish much, even if no effort were made to secure the broader revision desired. If it were intended, however, to apply for a commission, this time was probably as good as any other. Mr. Jannus having remarked that he never knew an incompetent examiner dismissed, Mr. Lockwood added that he did not think anybody did. It was always the competent examiners that got out of the Patent Office.

Mr. FOWLER: I think if the National Electric Light Association were to present some bill in Congress which would increase the pay of examiners, say fifty or one hundred per cent., it would go a great way toward removing the evils of the Patent Office than everything else combined. In one year we counted among the examiners that twenty-three of them resigned, about one-sixth of the whole corps. The Patent Office now is filled with new men. Until a man has examined for one year he is absolutely worthless in the Patent Office. I have been troubled a great deal myself since I have been out of the Patent Office with these questions of form, and I know exactly what it means. If gentlemen here had any conception of the work that is thrown upon examiners they would know what it means. It is a great deal easier to raise a question of form than it is to go down and examine the merits of the case. These questions of form are raised by men

who are so banked up with work that it is anything to get rid of a case. If the salaries of these men are raised and these men are kept there who can perform three or four times the work that new or inexperienced men can perform, this reform will follow. I was talking with an examiner, a friend of mine, whom I met in New York a few days ago, and he said this is the way to work, and I thought it was a very poor one; it is anything to shelve a case. He has little rollers—stamps—that he rolls across the paper, the division, record, process and everything—*ex parte* something—he rolls them over the sheets and hands them over to the clerk, and she writes a letter. That case is got rid of. I was very much struck with this question of form when I was in the Patent Office. There was a case which had been on its merits twice to the board and once to the Commissioner, and it was a case we were very much harrassed about. It was a question whether the thing was patented, and one of the gentlemen in charge asked me to take hold of the case and make an examination upon the merits. I took hold of it, spent some little time at it and I found two English patents for exactly the same thing, and yet the case had been appealed to the Board twice and to the Commissioner once upon the question whether the thing was patented. That just illustrates the point exactly. They will raise these questions of form to get rid of the case rather than examine the merits, because it looks too long. They want to be up to date with the work as near as possible.

Now this question of limiting American patents by foreign patents does not strike me as being such a terrible thing. It is easily gotten around. It is the popular impression that all foreign patents limit an American patent, and yet it is only so when a foreign patent is previously patented. It is easy enough to file your foreign patent on the same day that the American patent issues, and the foreign patent does not limit the American patent nor does the American patent limit the foreign patent in any way.

I am a believer in compulsory licenses as they have them in England. I do not think one man should be able to get a broad claim allowed and prevent improvers from using improvements. That is what the laws of this country give them. In England a board of commissioners fix how much a license is worth, and they make a man with a foundation patent give a license to another party so that an improver can use his invention. There are lots in this country who have valuable improvements locked up in their safes. In that way they impede progress. I have in mind one company who say they don't want to change the machinery although there are a great many inventions in their line that are better than the devices they use; and they buy up such patents and put them in their safe.

Mr. MULLER said that after he had been to Germany to appeal on some patent cases, he came back satisfied with the office and the practice in America, though he had been dissatisfied before. He was not in favor of high pay generally for the examiners, but a merit system, and he believed that something might be done in regard to a patent court.

Mr. E. C. DAVIDSON remarked that there was no system for the administration of affairs among men so perfect that it was not open to objection by theoretical perfectionists. Probably, too, attorneys quite as much as examiners were tainted with original sin. "The question we must come back to is this: Is not our patent system, as we have it to-dav, the best that we can get, with some trifling corrections, and would it be wise for us to open the door to a general revision of the entire system and invite changes which will require interpretation, which will require decisions, and break down all the lines of how they are to be interpreted and overthrow a doctrine in regard to patents based upon some three thousand or more judicial opinions? I think not. As soon as a revision of the laws is invited by a commission, such as has been suggested, every man in regard to the patent law will appear, or combine with others, and appear before such a commission and seek to grind his own axe. We will have before such a commission all the gentlemen who are in favor of protecting innocent purchasers. It seems to me I may be permitted to bring the discussion to what I understand to be the real point of it, that is, the propriety of making an apolication to Congress for the revision of the laws. Everybody assumes there are some imperfections. I should think we ought to treat them like any other business enterprise. No business man goes to another and says: 'I have got a claim against you; I don't know just what it is, but if you will help me to find out I think we can get it.' This is no way to get at it. We ought to decide what we concede to be the points to be secured for the improvement of the patent system and then when we know just what we want to go and ask for it, and let the manufacturing interests and the inventors bring in their influence to bear upon the politicians. I believe in practical statesmanship. I do not believe in ideal statesmanship. Let us select those things which are obtainable and make a direct application for them."

The resolution proposed by Mr. Kinter was here brought up, but upon motion was laid upon the table.

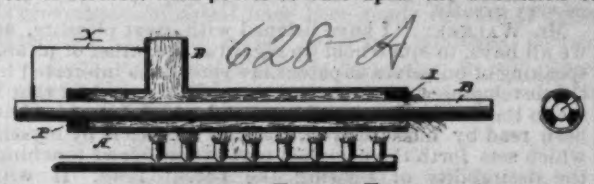
The subjoined is an abstract of part of the correspondence received by the secretary of the Institute on the subject:

Prof. ELIHU THOMSON was in favor of any movement calculated to improve the patent system. He recommended the remodeling of the law relative to the bearing of foreign patents upon home patents, He pointed out how, very often, inventors under present conditions had to apply for and take out "just such patents as involve no invention, but only aggregation and mechanical skill" for self-protection, "to prevent being harrassed in the development of their real inventions by the pseudo inventor or quasi mechanical improver." He added: "I seriously doubt whether any patent system can be devised which will not in many particulars become outgrown in a moderate period of years. Our present system seems in many respects to have been so outgrown, and if not revised will become more outgrown as the needs of the industrial arts develop in new lines."

Mr. EMILE BERLINER would like to see better salaries for the Patent Office staff, a patent court established and a provision that no citizen of a foreign country should obtain a United States patent for a longer period than an American citizen can obtain one in the said foreign country.

Mr. E. E. RIES favored revision and proposed that an inventor should be given at least a year within which to secure himself abroad. He also wished to see the erasure of all laws as to the working of patented inventions within a specified time, it being "to the self interest of the owners of a patent to work the same as early as possible, if it is worth working at all."

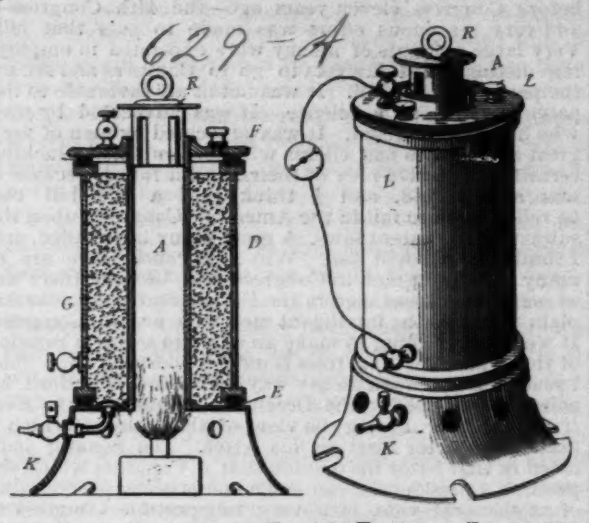
Mr. E. N. DICKERSON, JR., considered that it would be exceedingly disadvantageous to attempt to meddle with the patent law at present. He thought that the system of taking depositions in patent cases "amounted very frequently to a substantial oppression of the weaker by the stronger." A plan perfectly feasible would be that all depositions in patent cases should be taken before a master or referee, with power to rule upon the admission of



FIGS. 1 AND 2.—ACHESON THERMO-ELECTRIC GENERATOR.

evidence. Reform in this line would decrease by one-half the cost of patent litigation.

Mr. G. H. STOCKBRIDGE was of the opinion that something in the nature of the patent court proposed by the National Electric Light Association was the best thing yet brought forward to secure uniformity of practice and decision in the Patent Office. He pointed also to certain reforms desirable in the interest of inventors in the matter of reissues. "There should be some law framed to make the government entirely responsible for any abuse of power or any false judgments relating to patent applica-



FIGS. 3 AND 4.—ACHESON THERMO-ELECTRIC GENERATOR.

tions on the part of examiners. I would have this also extend to cases of fraud. It is not good morals and ought not to be good law for one party to a fraud to repudiate the consequences of it. Whenever, by reasen of fraud, a patent issues to one who is not the first inventor, the wrong can be righted by legal means already provided. But whether there be fraud or not, the government cannot justly disclaim for itself a responsibility which it insists upon on the part of the inventor. The injustice of the present ruling is apparent when one re-

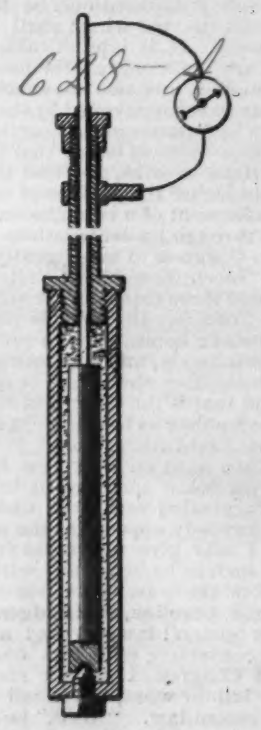


FIG. 5.—ACHESON THERMO-ELECTRIC GENERATOR.

flects that it is often impossible to get from the office claims co-extensive with one's invention, and that there are penalties for delay in the prosecution of an application."

Mr. A. ROBINSON thought that if the matter was urged, "the probability is that what we shall get will not be what we ask."

Mr. MELVILLE EGLESTON regarded the proposed inquiry as an important one, and urged strenuously that the Patent Office should have control of its own earnings.

Mr. F. R. HARDING favored thorough and immediate changes, and proposed making the Patent Office a separate department, with a Commissioner appointed for life, as judges are, and with an adequate salary. The rules of practice should be revised and rendered mere specific and lucid. He condemned the system with regard to foreign patents.

A New Thermo-Electric Generator.

In the thermo-piles or thermo-electric generators of that class heretofore constructed it has been customary to place a series of couples of conductors, separated in the thermo-electric series as much as possible, in contact with each other, to heat one portion of the couples artificially and to allow the other portions to cool either by radiation or to be cooled by the application of some cooling agent. The difference of temperature between the two portions thus obtained was necessarily very low, and the electromotive force of the current yielded by an apparatus of this kind was necessarily small.

In all attempts which have been made to produce electric currents with a combination of solids and liquids, it has been found that although the current obtained may at the first moment of heating one of the conductors be of considerable strength, it rapidly falls, owing to the formation of gases upon the surfaces of the solids and to other peculiarities in the investing fluid, as shown by Faraday. In order to avoid these objections and to increase and maintain the difference of temperature between the two thermo-electric elements so as to increase the E. M. F. of the current, Mr. Edward G. Acheson, of Pittsburgh, Pa., has hit upon a novel idea, which has led to the construction of a simple apparatus which is the subject of a recent patent.

The inventor accomplishes the object sought for by separating the two thermo-electric elements by a moving, conducting fluid, and by applying heat directly to one of the elements, so that the temperature of the other element can never rise above the boiling point of the conducting fluid which separates it from the first. From this it will be understood that, while one of the elements to which the heat is directly applied may be raised to a comparatively high temperature, the other element will be comparatively cool, and that consequently a current of considerable tension will be produced in the external circuit of the couple. The movement at the surface of contact between the solids and liquids prevents the accumulation of gases on their surfaces, and consequently overcomes the decrease in the strength of the current.

One form of apparatus in which this idea is carried out is shown in the accompanying illustration, Figs. 1 and 2. It consists of a metal tube *A* and a rod *B*, which may be of the same metal, and which is separated from the tube at one end by a solid plug *P*, and at the other by the web *I*, both the latter being of insulating material. Water or other liquid enters the pipe through the tube *D* and discharges at the web *I*. Thus the rod *B* is surrounded on all sides by the conducting liquid, but is otherwise insulated from the tube *B*.

The tube is heated from below to any desired degree, and the heat thus imparted will be conducted to the liquid and to the rod *B*. But, as is well known, liquids communicating with the atmosphere cannot be heated beyond the temperature of their boiling point, all excess of heat being utilized in the production of steam or vapor. Thus, in the apparatus shown, if water is used, the rod *B* cannot be raised in temperature above the boiling point of water, or 212 degrees Fahrenheit, and with a steady flow of water will be much less than that. Hence the tube *A* may be raised and maintained at a much higher temperature, and if the two be connected by an external circuit *X*, a current of considerable tension, according to the inventor, is generated, which continues as long as the difference of temperature is maintained. The moving liquid carries with it the steam or gas developed, preventing the drop of electrical potential due to the adhesion of the gases to the surfaces of the elements which might otherwise take place. It is evident that any number of thermo-electric generators constructed upon this principle may be connected in series so as to furnish a current of any desired tension.

In the apparatus just described the inventor employs a liquid as the conducting medium between the two electrodes, but in another apparatus embodying a similar principle he employs a moving fluid in the shape of a heated gas, it being well known that gases when heated become conducting. One form of apparatus in which this method is embodied in shown in perspective and section respectively in Figs. 3 and 4.

The body of the generator consists of two concentric cylinders. The inner, hollow cylinder is secured to a base, and is surrounded by, but insulated from, the outer *D* by means of a ring of asbestos *E*. Upon the outer cylinder rests the insulated cap piece *F*. A slotted plug *R* serves to control the heat in the well known way.

The space between the two cylinders *G* is filled with a material which, upon being heated, evolves gas, and for this purpose the inventor employs bi-oxide of manganese, or the same substance mixed with chlorate of potash, which liberates oxygen when heated.

The inventor has also obtained results by supplying the space *G* with a gas, such as oxygen, which is admitted through the cock *K*, and which percolates through the powdered material. The vent cocks *K'* control the flow of the gas liberated.

Still another form of apparatus embodying the same idea is shown in Fig. 5. In this apparatus the heat is applied to the outside, so that by plunging the same in a sand bath, for instance, or other source of heat, a current is generated.

The Lahmeyer Dynamo.

There has recently been brought out in Germany a dynamo machine which is said to give very good results, and in which the construction adopted is worthy of notice. The principal idea embodied in the construction is the reduction, as much as possible, of the magnetic resistance; and in order to accomplish this the first step taken was to adopt a construction which would permit of as little scattering of the magnetic lines of force as possible, and at the same time avoid joints in the magnetic circuit which offer more or less resistance to the magnetic flow. The machine constructed with this design in view is shown in perspective in Fig. 1, and Figs. 2 and 3 show respectively a transverse section and end view of the machine. The pole pieces, which are quite short, are surrounded by coils which generate lines of force that branch out and pass over by the paths *B B'* in the direction of the arrows shown. In order to avoid as much as possible the branching of the lines of force from pole to pole outside the armature, the distance, *a b*, between the poles is made as large as possible. The whole machine, together with the base, is cast in one, so that it presents a most compact appearance. The armature of the dynamo is of the Siemens drum type, and is built up of soft iron discs insulated by thin paper washers. At suitable intervals the plates are separated, and through these the air passes up, being admitted through the vent-holes *L* at the end of the armature, shown in Figs. 4 and 5. In this way the armature is prevented from over-heating. In order to protect the machine from accidents by the entrance of foreign matter into the armature, a grid is placed within the arm, which is shown in Fig. 1, completely protecting the internal moving parts of the machine.

In a recent test made on this machine by Prof. W. Kohlrausch some very interesting data regarding the construction of the same are given, which show that the average efficiency of the machine tested was over 80 per cent.

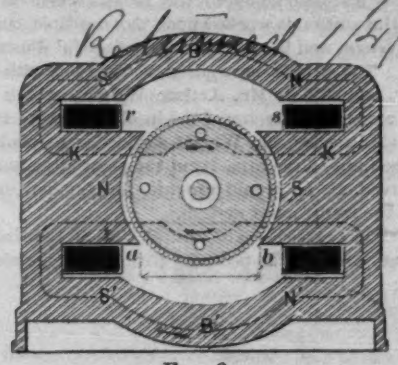


FIG. 2.

The machine, which is the one illustrated, is constucted according to the following data:

Revolutions per min	1,200
Current	60 amp.
E. M. F	65 volts.
Weight of machine entire	597 kg.
Weight of cast-iron	420 kg.
Length of armature drum	300 mm.
Diam. of armature discs	170 mm.
Thickness of armature discs	0.75 mm.
No. of discs	330
No. of commutator bars	38
No. of turns on armature	76
Diam. of armature wire	2.2 mm.
Current density in armature wire per sq. mm.	8.3 amp.
Weight of armature wire	2.3 kg.
Output per lb. of armature wire	1,700 watts.
Resistance of armature warm	0.112 ohm.
No. of turns in shunt field coils	2,000
Weight of shunt field coils	38.5 kg.
Diam. of wire in shunt	1.6 mm.
Resistance of wire in shunt	21 ohms.
Current in shunt	3 amp.
Current density in shunt per sq. mm	1.5 amp.
No. turns in series field coil	25
Weight of " " "	9.5 kg.
Diam. " " " "	6 5 mm.
Resistance warm series field coil	0.02 ohm.
Current density per sq. mm. in series field coil	1.8 amp.

The machine, as will be noted, is compound wound, and tests have shown that the electromotive force remains practically constant for all loads, no sparking being visible at the commutator. We may add that this machine is now being introduced into this country by Mr. E. Imhauser, of this city.

Lighting Buoys by Electricity.

BY HENRY A. REED.

The only lighted buoys in the waters of the United States are, I believe, two in number, and these are lighted with gas, in Charleston harbor. As the buoys in our Northern harbors are subject to submersion and rough handling by ice flows, gas lamps would not answer on them, and the Light-House Board has recently decided to try electricity.

For the experiment a spar buoy 35 feet long, two feet at its greatest diameter, and tapering to about 10 inches at each end has been secured to a half spherical sinker weighing 3,600 pounds, and has been fitted up to take the place of the present bell buoy off Robbins' Reef in New York harbor. The Edison company is preparing a 50 candle-power lamp to be attached to the top of the buoy, and the Bishop Gutta Percha Company has completed a two conductor submarine cable to connect the lamp with the dynamo, which will be located on shore at the headquarters of the Third Light-House District, at Tompkinsville, Staten Island, which is over a mile from the buoy.

The board hopes to determine by experiments the following questions:

1. Is lighting buoys practical at all?
2. Is it practical to light them by a single conductor cable depending upon the earth for the return current?
3. Can a lamp be protected to withstand the ice floes and still give sufficient light?
4. What is the conducting capacity of copper wire insulated with gutta percha in a submarine cable?

The English Government and the Channel Cables.

The negotiations between the French and English governments for the joint working of the submarine cables across the English Channel have progressed so far that no

FIG. 1.—THE LAHMEYER DYNAMO.

doubt whatever is now entertained but that a satisfactory working arrangement will be arrived at. After the return of M. Coulon, the French Postmaster-General, to Paris, the negotiations were continued by M. Waddington, the French Ambassador, and the provisional agreement arrived at has been taken by his Excellency to Paris for ratification by his government

In the meantime, reports the London *Electrical Review*, the directors of the Submarine Telegraph Company who were dispatched to Paris with a view to influencing the French government in their behalf have returned to London and reported the failure of their mission. The French government are so far committed to the proposals of the English government, that they distinctly decline to consider the question of any prolongation of the concession to the Submarine Telegraph Company. The English government have been equally firm, the final resolution of the Cabinet just communicated to the Submarine Company setting forth that having thoroughly examined the question, they have "decided not to grant a prolongation of the company's license to land cables on British shores, and not to renew after Jan. 12, 1889, the working agreement between the Postmaster-General and the Submarine Company." This communication really concludes the matter so far as the company is concerned, as if they cannot "land cables on British shores "it puts an end to their business. The only hope for the company lay in their being able to pursuade the French government to thwart the scheme of the British Post Office.

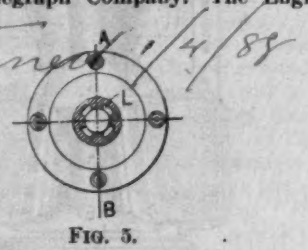


FIG. 5.

The Post Office is desirous of dealing generously with

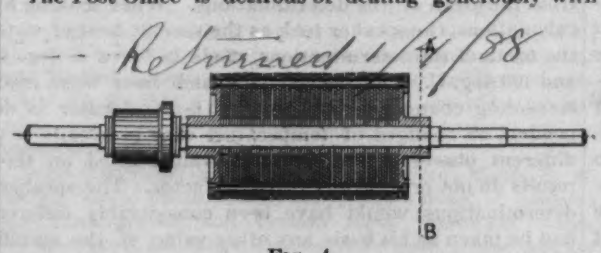


FIG. 4.

the working staff of the Submarine Telegraph Company, "recognizing that it is a large and deserving one." Many of them have been the first workers of the Submarine Telegraph Company. They are experienced, and could only by degrees be replaced. This resolve of the government is certain to meet with full and general approval. But though the authorities will fully consider the claims of the staff, they are still disinclined to pay anything more than the bare value for the cables and plant; and as the cables are practically valueless to anyone but the Post Office, it follows as a matter of course that they will get the cables they require upon their own terms. The contention of the government is that the concession to the Submarine Company was for a limited term, and that the directors recognized the precarious nature of their holding by building up a reserved fund to meet the possible contingency of a further concession being refused. As the Submarine Company will be able to pay their stock at par, the authorities fail to see that anything further is required.

So far as the cables are concerned, the four which connect with France are in good order, recent repairs having made them almost as good as new. The two single cables to France now used by the American telegraph companies are also working very well. The two Belgian cables are in a fair condition, and possibly, taking all these facts into consideration, the British Treasury may make a more generous offer to the company than would otherwise have been the case.

A New Experiment in Magnetism.

The circular magnetization which is developed in an iron wire while conveying an electric current has not, says the London *Electrician*, hitherto afforded any direct experimental proof of its existence. Its effects in increasing the self-induction of the wire have been dealt with by Prof. Hughes, Lord Rayleigh and others. We may also mention the proof afforded by Wiedemann's experiment on the longitudinal magnetization of an iron wire conveying a current when submitted to torsion. But owing to the magnetic circuit being closed in the iron itself, direct experimental evidence of circular magnetization was not forthcoming. A very simple and conclusive experiment has, however, been devised by M. Paul Janet, and formed the subject of a note recently presented to the French Academy by M. Mascart. M. Janet takes a cylinder of iron 30 centimeters in length by 1.5 centimeters in diameter, which has been cut longitudinally in halves and fitted together with great nicety. A current of from 30 to 50 ampères is passed

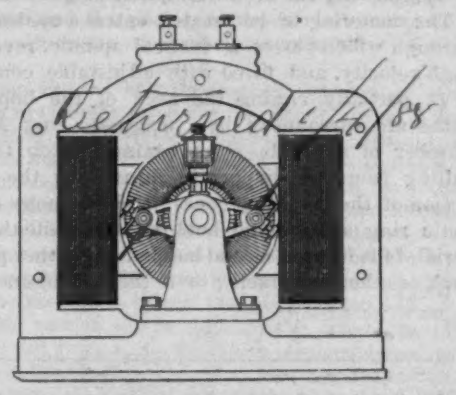


FIG. 3.

through the cylinder for a few seconds. The two halves are then separated. A sheet of paper is then placed upon one of the two plane sections, and dusting iron filings on this we find that, except near the ends, the filings arrange themselves in straight lines perpendicular to the two generating lines of the cylinder which form the longer sides of the rectangular boundary of the section. At the two extremities of the section the filings are arranged in curved lines, with their convex sides outwards. This shows clearly that the two generating lines are the *loci* of the poles of a series of semi-circular magnetic filaments, so that the whole cylinder must be built up of a series of annular magnets concentric with the axis, and magnetized with an intensity increasing with their distance from the centre, which is the distribution of magnetism indicated theoretically. A further verification may be obtained by suspending a magnetized needle parallel to one of the plane sections placed horizontally, when the needle will set itself perpendicular to the axis of the cylinder.

Elieson's Electric Locomotives.

Since Aug. 1 the Elieson cars have run a total distance of over 20,000 miles in London, in the most perfect and punctual manner. Statements of the number of passengers carried have been supplied by the North Metropolitan Tramways Company, which conclusively prove that the public prefer this mode of conveyance to horse cars, and we shall not be surprised, says the *Metropolitan*, if an outcry be shortly raised against the use of horses for hauling heavy cars, now that it has been clearly proved that the problem of drawing them by electricity has been successfully solved, and that it is unattended by the risks, dirt, smoke and offensive gases which appear inseparable from the use of steam.

Two Bells in Circuit.

To the Editor of The Electrical World:

SIR: Can you inform me how two or more electric bells can be worked successfully on circuit, using one battery and one push button, but each bell having a different strength (resistance)? NOVICE.

BRANDON, Manitoba.

ANSWER.—One way of accomplishing the result is to connect up all the bells in parallel, but their resistances must all be equal.—EDS. E. W.

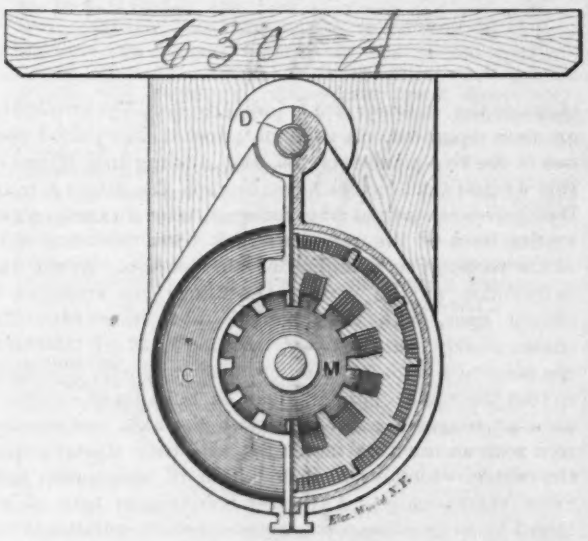
Holroyd Smith's Magnetic Separator.

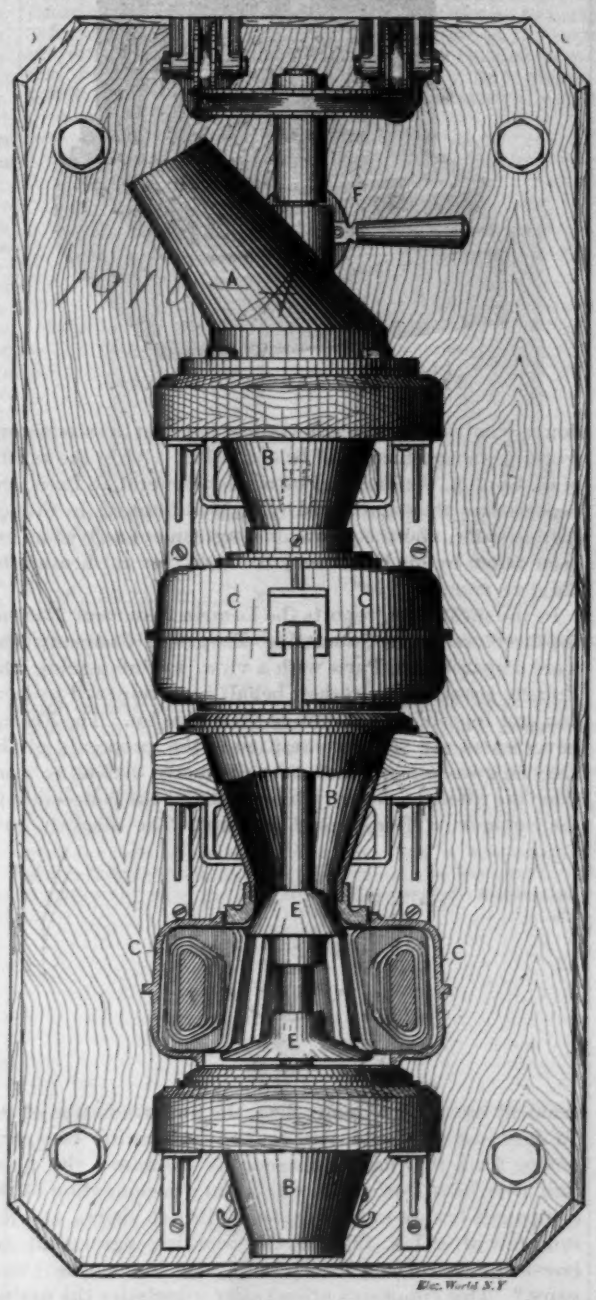
In the process of pottery manufacture it is usual to employ various materials, among others, flint and spar. These have to be ground to an impalpable powder in order to mix with the other ingredients and to be suitable for the pots when made. The old-fashioned process is to calcine the flint, crush it in any kind of a crushing machine to the size of about a walnut, and then place it in what is called a sulphur mill, which consists of a large circular pan with huge, flat stones swept round it. The process is very protracted, tedious and exhaustive, and it has long been the desire of potters to expedite their work. But, unfortunately, when it is attempted to reduce flint by any rapid means, it is necessary to employ machinery constructed of iron, and the flint, being so very hard, grinds away the surface of the iron-made machine and becomes so impregnated with iron as to render it absolutely useless for pottery purposes. It has therefore been a thing long to be desired by the potters, to extract the iron from the flint powder, if possible. Numerous attempts have been made to accomplish this, without success; for it is a much easier matter to take a nail out of a sack of straw than it is to take an infinitesimally small particle of iron out of a spoonful of flint powder reduced to the fineness of the finest snuff.

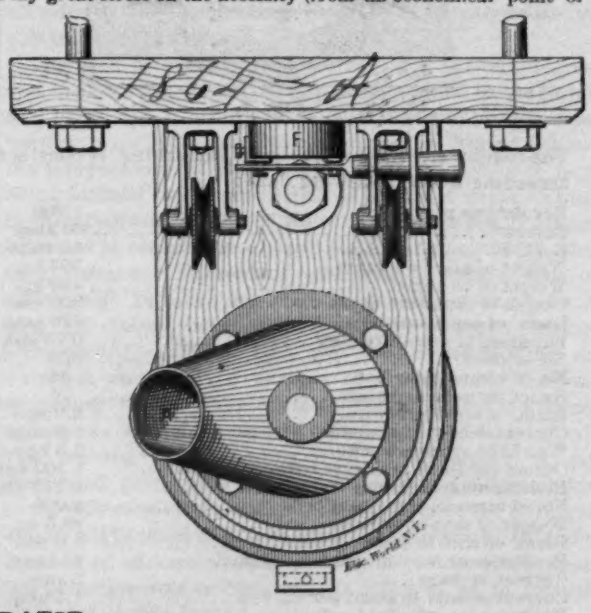
An enterprising potter in England, at considerable expense, put down a costly plant and succeeded in reducing his flint to the necessary powder fineness; but he was forced to stop here because the stuff was so thoroughly saturated with iron as to render all his outlay useless. He was referred to Mr. M. Holroyd Smith, of Halifax, England, who at once set to work with a view of devising a machine for this purpose, and has succeeded in doing so to the satisfaction of the potter.

The apparatus is shown in the accompanying illustrations, Fig. 1 being a front elevation partly in section, and Figs. 2 and 3 a plan view and a part section, respectively, showing one of the magnetic rings of the separator.

The material to be treated enters a conical hopper *B*, through which passes a vertical spindle, revolving at a high velocity, and fitted with adjustable cones or discs *E E*, partially closing the neck of the hopper. These cones are surrounded by a magnetic ring *M*, having a number of alternate poles, against which the material falling from the hopper is thrown by the centrifugal action of the revolving cones; and the poles of the magnetic ring attract and hold the iron while the other material falls into a second hopper, and either passes into a sack or other receptacle; or if the one magnetic ring has not sufficiently extracted the iron, a succession of such cones and rings may be placed one under the other.







FIGS. 3, 1 AND 2.—HOLROYD SMITH'S MAGNETIC SEPARATOR.

To facilitate the clearing of these rings they are in halves held in cases *C* which hinge upon a vertical rod *D* parallel with the spindle. The cases are provided with brushes or springs which make contact, when the case is closed, with the terminals of wires from a dynamo or battery supplying the current to magnetize the ring; and when the case is open it breaks contact with these terminals, thus demagnetizing the ring and allowing the iron to fall.

The cones are arranged so that the material will be thrown outward in a sheet or veil in such a manner that all the particles may be brought into close contact with the magnetic poles. Another advantage of the revolving cones consists in the fact that iron being of greater specific gravity than flint or other material the centrifugal force causes the iron to be thrown against the poles of the encasing magnetic ring.

One of these machines has been sent over to this country and has been subjected to a severe test by one of our largest potters. Uncalcined flint, which had been powdered in a centrifugal machine, was first of all passed through Mr. Smith's apparatus at the works of Messrs. J. H. Bunnell & Co. of this city, and, to the astonishment of the potter and his friends, the iron was satisfactorily extracted; but as the potter is adopting a new pneumatic pulverizer, which reduces the flint to a much finer state than any centrifugal machine has yet succeeded in doing, he was anxious to see it tested upon his own material. The pulverizer company, therefore, supplied samples of both flint and spar, and these were also passed through the machine with a satisfactory result. To give a final test, 10 pounds of powdered spar, finer than the finest flour, was taken, and with it was mixed half an ounce of equally fine iron dust which had been specially prepared for the purpose. The whole was then passed through the machine, and at one passage over seventy-five per cent. of the iron was extracted. The success of this machine will, it is believed, open a wide field of advance in the pottery trade; for the material can now be reduced at four times the rate, at less cost.

Electrical Determination of the Mechanical Equivalent of Heat.

At a recent meeting of the Berlin Physical Society, Dr. Dieterici gave an account, says the London *Electrician*, of his experiments on the determination of the mechanical equivalent of heat by the indirect electrical method. As the results of his series of measurements, he obtained closely agreeing values for the mechanical equivalent of heat, viz., 424.4 and 424.2 as the mean of each series; the highest and lowest values obtained differing but little from the mean of the determinations. When making his calculations, the speaker took as the specific heat of water the mean of the determinations made between 0 deg. C. and 100 deg. C. The statements which have been made respecting changes in the specific heat of water as dependent on changes of temperature vary so greatly with different observers that the mean values based on their results do not provide any constant factor. The speaker's determinations would have been considerably different had he taken as his basis any other value of the specific heat of water. He next compared the results of his experiments with those of earlier observers, and discussed the very marked differences in the values given for the specific heat of water at various temperatures. He thinks that the specific heat of water may best be determined by the electrical measurement of the mechanical equivalent of heat, and intends to investigate this question more fully at a later date.

Railroaders and Telegraphers.—The annual meeting of the Railroaders' and Telegraphers' Mutual Aid Association at Cleveland has just been held. The total membership at present is 110. The receipts during the year were $652.89; disbursements, $244.30; balance on hand, $773.45, showing a great increase over the balance of the preceding year. Mr. D. S. Schnoo was elected president and Mr. L. B. Seibel secretary.

ENGLISH NOTES.

LONDON, Dec. 14, 1887.

The annual general meeting of the Society of Telegraph Engineers and Electricians was held on Thursday last, when the election of the president, members of the council and other officers for the ensuing year took place. Sir Charles Bright is succeeded in the presidential chair by Mr. Edward Graves, who holds the position of engineer-in-chief to the Postal Telegraph Department. Mr. Graves is personally very popular, and his election resulted from a practically unanimous vote The council has been strengthened by the accession of Mr. Gisbert Kapp and Mr. W. M. Mordey. The report read by the secretary showed an increase of 119 members and associates for the year. It was announced that a proposal would be laid before the society to make an alteration in the style and title, so as to mark the wider scope and increased importance which it has attained. "The Institution of Electrical Engineers" is the title proposed by the council. There is little doubt that this change will be adopted. Dynamo men have long felt it to be anomaly that the sole recognition of their professional status should be derived from membership with the "Society of Telegraph Engineers," even though the phrase "and Electricians" were added.

A paper by Mr. Arthur Cochburn was read at the same meeting on the important subject of "Safety Fuse for Electric Light Circuits." Mr. Cochburn employs a fusible wire which is loaded at the centre with a small bullet, and it is found that by this device great constancy of action is insured. It is well known that ordinary fuses of this description frequently get red hot, and remain red hot without breaking. Mr. Cochburn attributes this to the formation of a film of oxide upon the surface of the wire. Of course if the wire is weighted at the middle it must give way. The effect of a strain upon the heated wire is found uncomfortably manifested in the case of the Cardew voltameter, where the working wire is attached to a spring at one end, and although the fusible wire is generally made of half sectional area, it is often the case that the working wire gives way and leaves the fuse intact.

At one of the earliest meetings of the society for the ensuing session, a paper on transformers will be read by Mr. Gisbert Kapp. This paper is looked forward to with considerable interest.

A 70 unit alternating current dynamo, built by Elwell-Parker, has just been added to the Brighton central station. At present, this station is worked upon the multiple series constant current system, and is a remarkably successful illustration of that method. The details have been worked out with considerable ingenuity and skill by Mr. Arthur Wright, who is both electrician and managing director of the local company. But, notwithstanding this success, Mr. Wright decided some while ago that as soon as the limit of the capacity of the plant already installed had been arrived at, he would provide for further extensions by means of the transformer system.

Mr. Wright's experience of central station lighting leads him to lay great stress on the necessity (from an economical point of view) of varying the speed of the engine with the output of the station. With a direct current system this does not involve any special difficulty, because an arbitrary alteration of speed can be counteracted by an adjustment of the strength of the exciting field. But with transformers the case is altogether different. We cannot vary the speed of the machine without at the same time varying its rate of alternation, and the rate of alternation cannot be varied without at the same time varying the E. M. F. at the terminal of the secondary coil. The problem does not therefore admit of any very obvious solution, except indeed by arranging the driving gear in such a way that the relative speeds of engines and dynamos may be so adjusted that the dynamo speed may be kept constant, while the engine speed is varied. This is of course quite possible, but it is not a very practical arrangement. The whole object of such a method of working is solely for the sake of economy, and if it is possible to introduce such a system at all successfully it must be done by some purely electrical method.

Some interest has recently been excited by the fact that alternating currents of such periodic time as are employed in practice are capable under certain conditions of affecting electrolytic decomposition. It is of course obvious that if we take an alternating current of very small periodic time; that is to say, with very rapid alternations, and pass it through a voltameter, and then gradually decrease the rapidity of alternation, we must at length arrive at a point where decomposition is effected, and under suitable conditions a liberation of gas results. It would appear that in a determination of the particular period for which this occurs with a given electrolyte under given conditions of temperature, any pressure must be a matter of considerable theoretical importance, although it is a point which does not appear as yet to have received investigation. It is furthermore obvious that if an elec-

trolyte can be found which will undergo decomposition by an alternating current such as is used in practice, it would become possible to construct an alternating current meter upon this basis. This has in fact been already done, and such a meter has been under test for some considerable time with excellent results. I am not at liberty to say more at present, but no doubt something further will be heard of this apparatus before long.

Your readers will very probably be interested in the following list of English central lighting stations which are already in existence. The list is probably an incomplete one. I shall not at present attempt to give more than the name of the station and the system employed:

London (Grosvenor Gallery), Ferranti transformers.
London (Rathborne Place), Mordey transformers.
London, Holborn, Pilsen Joel arcs.
London, Tottenham Court Road, Pilsen Joel arcs.
London, Kensington Court, Crompton dynamos, direct supply with storage batteries in central station.
Liverpool, Rose street, direct supply in some cases with storage batteries on consumer's premises.
Sheffield, arcs.
Bradford, York, direct.
Leamington, Edison distribution.
Taunton, Thomson-Houston.
Exeter, Thomson-Houston.
Waterford (Ireland), Thomson-Houston.
Cardiff, Brush system (incandescent lamps in multiple series).
Brighton, Brush system (incandescent lamps in multiple series).
Eastbourne, Lowry transformers.
Hastings, arcs.
St. Austell, direct (Kapp dynamos).

At least three times as many stations are either in progress or are projected, but besides the American record it must be confessed that in this particular we make a very poor show indeed.

During the present winter an attempt is being made to spread an interest in science among the working classes in London by the inauguration of a series of lectures, for which an admission fee of one penny is charged. The scheme is being actively supported by men of first-rate ability, and already Mr. William Lant Carpenter has delivered at the Shoreditch Town Hall a series of three lectures on "Electricity in the Service of Man," which have attracted crowded audiences and have been listened to with the utmost attention.

The Schanschieff primary battery is at present attracting a good deal of attention, and it certainly seems to be possessed of far more solid claims than the vast majority of new primary batteries which are so persistently placed upon the market. The mere fact of the Schanschieff battery containing only a single fluid is, of course, a tremendous pull in its favor, and the additional fact, which appears to be well established, that the net cost of the fluid does not exceed fivepence per gallon is also encouraging. For portable apparatus it would probably be difficult to find at the present time a more suitable battery.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
NEW YORK, Dec. 27, 1887.

The war on the bucket shops continues. The Grand Jury has now indicted the proprietors of the Standard Stock Company (limited), the largest bucket shop in the city, after that of Todd, which was raided a week or two ago. The case was submitted to the Grand Jury last month, but they dismissed the case, the evidence being insufficient. Since then, with the help of a detective agency, additional evidence has been obtained leading to the present indictment.

Quite a stir was created a week or two ago in engineering circles by the announcement that Babcock & Wilcox boilers had been ordered for the electric lighting plant of the Vienna Opera House, to replace those of European make that had failed. And yet it is not at all unusual for this make to be used abroad in preference to others of local make. I have been favored with a few figures on this point, and give below the November list of the output of the boilers of the Babcock & Wilcox Company.

	Horse-power.
Bibb Manufacturing Company, Macon, Ga.	208
Corporation of the Cathedral of the Incarnation, Garden City, L. I.	104
Georgia Lunatic Asylum, Milledgeville, Ga.	136
W. E. Cameron, Manchester, England	30
Anthero Arenjo, Lisbon, Spain	15
Louis Glorieux, Roubaix, France	166
Hammond & Co., London, for Spain	104
Arthur Butler, for Mootcharri, Tirhoot, India	40
" " " "	45
L. Fontaine, La Madeleine les Lille, France	138
Geo. Richard & Co., Limited, Broadheath, near Manchester, England	132
W. Clark & Sons, Liverpool, England, 3d order	126
Harding Croker, Lille, France	30
Walker Bros., London, for Ceylon, 5th order	25
M. Kennedy, Greymouth, New Zealand	248
J. & J. Boyd, Shettleston, England, 2d order	104
Louis Carrie, Marseilles, France	51
Cadogan Electric Light Company, London, England	208
Edison Electric Illuminating Company, of New York (for 39th street station), 3d order	803
A. Gillibert & Co., Marseilles, France	220
Bay State Sugar Refinery, Boston, Mass., 3d order	960
Cowles Syndicate Company, Limited, Milton, near Stoke-on-Trent, England	280

Making a total of over 4,000 horse-power for the month.

One of the most active agents in electric lights at present is Mr. Frank R. Chinnock, brother of Vice-President C. E. Chinnock, of the Edison United Manufacturing Company. Mr. Chinnock is agent of the Edison United Company for Long Island, Brooklyn, and the northern half of New Jersey, and has been very active during the past few months and closed a large number of plants, in nearly all of which he was brought into active competition with numerous other companies. Among some of the plants he has closed are: The new Pratt Institute in Brooklyn, 500 lights capacity; D. Appleton & Co.'s book bindery, Brooklyn, 300 lights; Adelphi Academy, Brooklyn, 500 lights; Queens County Oil Works, Newtown Creek, 300 lights; Scheuer Bros. wood working establishment in Brooklyn, 250 lights; Adams & Sons, manufacturers of the Tutti Frutti chewing gum, 200 lights; Tuttle-Bailey Manufacturing Co., 75 lights; John Good's rope works at Astoria, 150 lights; E. V. Crandall's factory in Brooklyn, 25 lights; Preston Fertilizing Company, Brooklyn, 50 lights; Oxley, Gildings & Enos' chandelier and electric light fixture works at Brooklyn, 500 lights; the new Welden Office Building, Jersey City, 350 lights; Camden Consolidated Light Company, in Virginia, 250 lights.

Also a large theatre plant of 1,200 lights capacity in the new Amphion Academy, on Bedford avenue, Brooklyn. This is to be one of the finest theatre plants ever installed, and will make the theatre one of the best and safest lighted in the country. The fixtures for the theatre were also sold by Mr. Chinnock, and are being made by Bergmann & Co. This plant is to have two dynamos of 600 lights capacity each, and one Armington & Sims engine, and all the latest regulating apparatus of the Edison Company for manipulating stage effects, etc. I do not know of any electric light agent just starting in who can show a better record than this for the short time he has been in the business. Mr. Chinnock was first given Long Island and Brooklyn, but he showed such energy and activity in closing contracts that part of New Jersey was added to his territory.

Mr. L. N. Downs is president of the Electric Fire Protective Company, of 15 Cortlandt street. This company is licensed by the Gamewell Auxiliary Fire Alarm Company for the States of New York and New Jersey, with exclusive use and control of all the patents and devices of the well-known Gamewell system. It is now prepared to enter into negotiations with reliable parties for the purpose of organizing and pushing the business in the different localities, and will make advantageous terms to its licensees.

The *Evening Sun* of Dec. 22 had an interesting and well-informed article on "Edison's lieutenants," meaning thereby those who have been and are most closely connected with the great inventor. It mentions and describes Mr. E. H. Johnson, Mr. C. Batchelor, Mr. S. Bergmann, Mr. J. Krensi, Mr. F. R. Upton and others, and gives a vivid idea of the careers of a very remarkable group of men who have been foremost in putting an entirely new industry on its feet, scientifically and commercially.

The American Electric Manufacturing Company has issued a circular to stockholders calling for subscriptions to treasury stocks at par, the proceeds therefrom to be used for the purchase of the property of the Electrical Development and Manufacturing Company.

Mr. R. M. Hunter, the patent expert of Philadelphia, has opened branch offices in this city at 237 Broadway. Mr. Hunter, who is a frequent contributor to the columns of THE ELECTRICAL WORLD, is well known in connection with electrical traction and other new developments.

At the meeting of the Board of Electrical Control last week, Engineer H. S. Kearney reported that the total length of the excavation made since last July was 129,918 feet; single-duct conduits for telegraph and telephone service, 903,180 feet, and distributing service, 4,050 feet. There was room for 13,700 miles of wire. The length of conduit for light and power wires aggregated 254,210 feet of single duct, giving a capacity for 2,542,500 feet of wire. In addition, there were 186,745 feet of conduit for incandescent light wire. These companies were using the conduits: Western Union Telegraph Company, 500 miles of wire in conduits, and the Metropolitan Telegraph and Telephone Company, 1,000 miles of wire, principally along Sixth avenue. Mr. Gibbens brought up the matter of compelling the telegraph and electric light companies to obey the law and put their wires in the conduits. He asked the Mayor if he would see that the law was enforced in the cases of the companies, and the Mayor said he would make no promises. He could not tell what he would do until the matter was submitted to him.

The Brooklyn Incandescent Electric Light Company, offices 292-296 Graham street and 337-341 Classon avenue, Brooklyn, uses the Julien storage system for lighting, and is installing plants in different parts of the city. The Mutual Electric Company is building at the works as above several of its dynamos specially for charging Julien cells, and the machines are to be placed in the Citizens' Electric Light Company's station. There is every sign of abundant work for the company. The Mutual Company, F. E. Otis president, and E. R. Knowles electrician, is installing a 50 arc light plant at Belvedere, N. J., including 31 double arcs and 19 single. Two 25-light machines, with engines and boilers, are now in place, and five miles of circuits have been run. The Mutual Company has lately sent to Canada one of its automatic time switches for cutting out storage batteries when charged, and has orders for 500 automatic lamp cut-outs to use on arc circuits when charging batteries or running motors. Fifteen of the new indicators for arc light stations will be ready this week for use in Brooklyn, New York and Canada. The company is also building ten motors for electric railway purposes, to be used in connection with storage batteries.

W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
BOSTON, Dec. 26, 1887.

Owing to the pressure of regular news I have been unable until this week to find any room in my notes for the various electrical and kindred exhibits at the annual fair of the Massachusetts Charitable Mechanics' Association in this city, and which has just come to a close. Probably a few words now, however, will be appreciated.

In the Grand Hall on the stage near the organ, Messrs. B. S. Hale & Son, of Malden, Mass., had a neat exhibit of insulated and bare copper, and German silver resistance, wires, magnet spools, gas fixture wire, telephone cords, rubber tape for winding joints, etc., all of which they manufacture in large quantities, thus enabling them to fill orders promptly.

In the basement of Grand Hall was a circular track about twenty feet in diameter on which ran a model car of the Enos Elevated Electric Railroad. This exhibit was looked after and its working demonstrated and explained by Mr. Geo. A. Johnson, the company's electrician.

Mr. Charles L. Bly, of Boston, was another exhibitor in the Grand Hall, and he made a creditable display. The exhibit consisted of electrical gas lighting apparatus, electric bells, chemical batteries, speaking tube terminals, annunciators, insulated wires, and, indeed, electrical supplies generally.

Adjacent to Mr. Bly's space was the exhibit of Messrs. Blodgett Bros. & Company, of Boston, which comprised various kinds of electrical supplies; also the Blodgett annunciator and the burglar alarm annunciator, which are useful inventions, and which find extensive use throughout the country. They also displayed electric gas-lighting devices, electric train starter, watchman's clocks for factories, etc.

In the basement of Grand Hall the New England Heat Regulator Company, of Boston, exhibited the Buts thermo-electric heat regulator, applied to a Magee "Mystic" portable range. The design of this is to automatically regulate the temperature in houses, so that furnaces will be no care to the housekeeper beyond feeding with coal and taking the ashes away.

The Boston Electric Company had a large space in the gallery of the main hall generously supplied with samples of the electrical goods it manufactures, and making a handsome display of its gas-lighting and burglar-alarm apparatus.

The various processes of electrotyping, as were shown in the exhibit of Messrs. H. C. Whitcomb & Co., attracted much attention. It included an electroplating dynamo of the Mather type from the factory of the Eddy Electrical Manufacturing Company, of Hartford, Conn.

The Leatheroid Novelty Manufacturing Company, of Boston, made an attractive and extensive display in Exhibition Hall of its leatheroid specialties for numerous electrical purposes.

A very neat exhibit of battery jars and cells for electrical uses was made in the Main Hall by the Union Indurated Fibre Company.

Messrs. Fred M. Kimball & Co., of Boston, were well represented at the Mechanics' Fair. Their nicely arranged exhibit in Machinery Hall of dynamos and other electric lighting apparatus of their own make attracted much attention and favorable comment.

The Ball Electric Light Company occupied the adjoining space to Messrs. Kimball & Company, and exhibited a dynamo of its make weighing only 520 pounds and producing 25 arc lights of 800 candle-power. Many electric light people consider that lights of the candle-power named are specially suited for lighting stores, hotel corridors and piazzas, and such public places where only a moderate light is required.

The Boston Electric Light Company deserves the gratitude of the managers of the Mechanics' Fair Association for the manner in which it furnished the illumination for the several large halls and basements of the Fair building. There were 225 arc lights distributed with excellent results. These were supplied from the company's stations on Ferdinand and Congress streets. The double lamps of the American system were used. The wiring and construction work and the placing of the lamps was carried out under the supervision of assistant superintendent Henry L. Stevens.

The Edison Electric and Illuminating Company, of Boston, made a very creditable display of the Edison system of incandescent lighting, and displayed at its attractive pavilion various sizes of plain and colored lamps, ranging from 4 to 100 candle-power. This company's exhibit was located on the principal walk of the Main Hall. Mr. C. L. Edgar, the manager of the company, and his assistant, Mr. Elbert L. Caldwell, were in charge. This company furnished incandescent lights for a large number of exhibitors. The total number of incandescent lights furnished by the Boston Edison Company was 440, and of this number 325 were in use in the extensive art gallery. These lights were fed from a No. 20 Edison dynamo driven by an Armington & Sims engine.

Messrs. Claflin & Kimball, of Boston, agents for the Mather Electric Company, of North Manchester, Conn., had an attractive display of a complete electric light and power plant, consisting of three Mather incandescent light dynamo machines, and a 10 h. p. Mather dynamo. This plant furnished lights for several exhibitors in Machinery Hall, and current also for running the electric car on the Enos Electric Railroad in the basement of the Grand Hall. The dynamos and motor were driven by a Ball engine exhibited by Messrs. S. L. Holt & Co., of Boston.

The Electric Gas Lighting Company, of Boston, presented to the patrons of the Mechanics' Fair a neat, varied and attractive display of electrical goods and supplies. Its pavilion was artistically decorated with electric bells of every description and size, and so arranged as to give the casual observer the idea that the top and sides of the little house were constructed entirely of bells. There was not, however, too many of the line mentioned to give "a sameness" to the exhibit, as there were many varieties of annunciators, watchman's clocks and time detectors, burglar alarms, electric gas lighting apparatus, electric gongs, electrical letter boxes, and, in fact, about everything which goes to make up a complete stock of electrical apparatus, goods and supplies.

The American Tool and Machine Company, of Boston, had an extensive display, which occupied two large spaces in separate sections of the basement of the Fair building, and was an attractive exhibit. This company's device for starting and stopping dynamos was of especial interest to the electric people who saw it in operation. This is said to be a perfect appliance for starting, stopping or controlling the dynamos, doing away with all friction or loose pulleys. The company had on exhibition also its friction cut-off couplings, centrifugal friction pulleys and a large variety of the latest improved machinery and tools. The exhibits were under the supervision of Mr. M. H. Barker, the assistant general manager of the company.

Messrs. Fuller, Holtzer & Company, of Boston, had a very handsomely furnished space in the gallery, over the centre of the Main Hall. Among the firm's attractive exhibit of its electrical goods and supplies were the following: Gravity drop annunciators, the French style of return call annunciators, a new form of Leclanché battery termed "The Holtzer Cylinder Battery," an electric wind indicator and anemometer, electro-mechanical fire-alarm gongs, watchman's time detector, plain and fancy push-buttons and gas-lighting keys, the new "Volunteer" pendant burner for electric gas lighting, a novel system of burglar alarm and electric call bells of all sizes. A very interesting feature of this exhibit is the firm's new system of lighting up gas jets instantaneously.

Over the exhibit of Messrs. Fuller, Holtzer & Company was a large sign bearing the legend to the effect that this firm are agents for the Edison Electric and Illuminating Company for the installation of the Edison system in Boston and vicinity.

The exhibit of motors made in various departments of the Fair building, by Messrs. Sawyer & Blake, of Boston, N. E. agents of the Sprague Electric Railway and Motor Company, was very creditable to the gentlemen named, and from the encomiums passed on their meritorious display it is safe to predict that the

Sprague Company's business will therefrom be largely benefited. The Sprague motors furnished power for a score or more exhibits; among these being large printing presses, pressure pumps, cotton and wool machines, paper cutters, a harvesting machine, a "Giant Mower," sewing machines, fans, blowers, etc., etc. The various motors were supplied with current from Edison dynamos, located in Machinery Hall, and throughout the two months' time (day and night) taken up by the exhibition, there was not the slightest hitch or a break-down in the power supplied.

The handsome and artistic display of scientific and telegraph instruments by Mr. A. L. Russell, of Boston, on the platform of the Grand Hall, attracted as much attention and favorable comment as any other exhibit at the Fair. Among the scientific instruments for electric light purposes and electrical measurements exhibited by Mr. Russell were rheostats, galvanometers and testing generators. These were all from the factory of Mr. Russell, on Court street, Boston, the establishment formerly occupied by Mr. Charles Williams, Jr. Among the above-named instruments were three beautiful and valuable sets which merit special mention. One was a powerful electric light testing generator, which rings a bell through a resistance of 16,000 ohms. Another was a combination set, comprising rheostat, galvanometer, key and bridge, which has a measuring capacity of $\frac{1}{10}$ of an ohm to 45,000 ohms. This is considered by the electrical fraternity as a compact and very useful instrument. Still another was a large standard set, composed of rheostat, Thomson mirror galvanometer, key and bridge. The latter is a set of instruments extensively used by the electric light manufacturing companies and manufacturers of electrical supplies and wire.

The Messrs. Heymann Brothers, of Boston, had on exhibition at their space in the Machinery Hall, a new invention in the line of arc lamps; in fact, a new departure from the old style, or ordinary pencil carbon lamp. The lamp referred to is only 15 inches high and 8 inches in diameter. Two discs or cylinders of carbon are rotated upon two shafts and make contact as they revolve, forming the arc. The carbons can be made to feed the lamps from thirty to sixty hours. The body of the lamp is circular in form and has a cone reflector suspended beneath its body, but which is above the carbons. This casts all the light downward, yet diffuses it in a radius of fully 30 feet from the lamp. The feeding mechanism is operated by a worm and ratchet actuated by a solenoid. This new lamp of the Messrs. Heymann Brothers gave fully 2,000 candle-power.

The steam plant of the Edison Electric Illuminating Co. of Boston was located in Machinery Hall, and contained the following equipment: Two Armington & Sims engines of 60h. p. each, one Wheelock engine, 175 h. p., one 500 light (No. 20) Edison dynamo for lighting purposes, and two 300 light Edison machines for running the Sprague motors.

The Fitchburg, Mass., Machine Works made an exhibit in Machinery Hall of a new engine it is manufacturing, and for which the claim is put forward that it is specially adapted for electric lighting purposes, and for running any kind of machinery where high speed is required. The engine exhibited was of 10 h. p. and said to be automatic and self-regulating. It occupied the remarkably small space of 3 x 3 feet. The engine is the invention of Mr. H. F. Hodges, of Fitchburg, Mass.

The Wainright Manufacturing Company, of Boston and New York, had a very attractive exhibit in Machinery Hall, which comprised various sizes of its well known feed water heater and corrugated tubing. The display was in charge of Mr. Charles Jacobs, the salesman of the company.

The Shipman Engine Company, of Boston, had a creditable exhibit in Machinery Hall of its automatic steam engine (3 h. p.), using low test kerosene for fuel. The company builds several sizes of this style of engine—from 1 to 5 h.p., stationary or marine. The consumption of fuel is ⅓ gallon of kerosene per h. p. per hour; the oil costs only six or seven cents per gallon. The engine displayed in the exhibit was running twenty-four 16 c. p. incandescent (Sawyer-Man) lights from a 50-light dynamo of the Thomson-Houston make, and three 2,000 c. p. arc-lights from a four-light Waterhouse dynamo. Ireson's self-adjusting link belts were used.

The varied and interesting exhibit of the Jarvis Engineering Company, of Boston, in Machinery Hall, which comprised appliances of various kinds connected with steam power production known throughout the whole country, was one of the most attractive displays at the Fair. Among the things shown were the National rocking grate-bar for furnaces of every description, that will produce steam with coal or screenings, tanbark, sawdust, etc.; the National feed water heater, which is at once simple in construction and cannot create any back pressure on the engine; Korting's universal injector, Korting's steam jet elevators, lifters and ejectors, or siphon pumps; improved power pump, and the magnesia sectional covering for steam-pipes and boilers, which is no doubt one of the best non-conductors of heat employed on steam generators or transmitters in the market.

The Ames oil engine, which was on exhibition in Machinery Hall, attracted a good deal of attention. It furnished power for an enormous Sturtevant blower. It worked smoothly and without any perceptible jarring. This engine occupied a space of only 4 by 6 feet; in height it was 8 feet, and it was said to be of 15 h. p. The gentleman in attendance said it consumed only one-fifth of a gallon of crude petroleum per horse-power per hour. This engine has two fly wheels, one of which is supplied with a governor, which will perfectly regulate—it is claimed—the load on either wheel. This engine was designed by Mr. J. H. Clark, and is built by the Whittier Machine Company, of Boston.

Another engine worthy of note, and which received considerable attention from visitors to the Mechanics' Fair, was the Lidback engine, which was located near the central entrance to Main Hall. It was of 10 h. p., a reciprocating or vibrating engine, high speed, very compact and economical in both space and steam. It occupied the very small space of only 24 by 30 inches on the floor, and in height is only 24 inches. It is set for 500 revolutions per minute. An engine of this make and same size, 10 h. p., has been in use since last spring in an isolated electric light plant at the factory of the Portland, Me., Stoneware Company, running 120 (16 c. p.) incandescent lights in a satisfactory manner. Mr. John Lidback, of Portland, Me., is the manufacturer of this engine.

Mr. Hermann Erhardt, of Boston, made a nice exhibit in the basement of Grand Hall of a small electric car on a circular construction representing an elevated railway. The car was fitted with patent trucks, having a swivel movement suitable for sharp curves, which can be used equally well on surface or on elevated railroads. The current for running the car was furnished from a small dynamo in the exhibit of the Tremont Electric Light Company.

The New England Electric Mail Company, of Boston, had on exhibition in the Main Hall its electric mail box, a most convenient and useful invention. This is similar in appearance to the ordinary boxes which are placed at the entrances of business buildings, apartment houses and private residences. It differs, however, in detail in being connected by means of wires with a small mechanism, which is inclosed either in the lower part of a clock or in a small wooden case with a glass front. This case is placed on the wall in any room of the building. The box, which contains a small electrical contrivance, is so constructed that when any mail matter is dropped into it the occupant of the room is immediately notified by the striking of a bell, and by the dropping of a white disc inside, which remains in view until the mail is removed. The same device was shown at the recent electrical exhibition in New York.

Messrs. Chauncey Thomas & Company, of Boston, had on exhibition an elegant brougham, with cradle spring hanging, and under the driver's seat an electric storage battery for lighting the carriage. This is said to be the first application in America of electricity to road carriages.

The exhibit of the Whittier Machine Company, of Boston, consisted of a hydro-electric elevator, which was run by an electric motor. The Hinkle system of hydraulic pressure was used, by which the same water is used over and over again. The electric elevator referred to is a new feature introduced by this company. The elevator is made to ascend or descend by merely pressing an electric button. This is a novelty which will be appreciated by owners of hotels and apartment houses where the passengers have to operate the elevator, as it does away with the pulling of the elevator rope, which is objectionable to many ladies.

The wire and cable display of the Washburn & Moen Manufacturing Company, Worcester, Mass., attracted the attention of all whose business is in any way connected with the goods there displayed. There is very little in the line of wire or cables in use by electric light companies and for electrical work of all kind that was not to be seen. Wire rope was displayed in sizes varying from a picture cord to a cable for a surface road. The exhibit gave a very notable and handsome illustration of the large variety of their products in wire drawing, the wires shown being iron, steel and copper. The chief feature occupying the centre of the case was a superb coil of No. 12 hard drawn copper wire, one mile and one-third in length, without break or weld. On either side of the coil were skillfully disposed the gauge sizes of iron, steel and copper wire from the largest size, or rods, to the highest numbers, some of these running to 52 of the Worcester or Washburn & Moen gauge. There were also shown the variety of springs made by the company, from the size of watch springs, a leading specialty, to springs of larger size for clock work and machinery. The case also contained samples of wire and steel cables, rope and cord, also large and small tested copper strands and wire for conductors of electricity. This copper wire of the Washburn & Moen Manufacturing Company is of two classes, hard drawn and soft.

In Machinery Hall, adjoining the tank, the Deane Steam Pump Company, of Holyoke, Mass., exhibited a fine collection of its pumping machinery and steam pumps. One of the most conspicuous machines shown was the powerful vertical engine for deep well pumping, which raised and lowered a weight of 1,250 pounds as easily as if it were but 250 pounds instead. In the Exhibition Hall, rear of the fountain, was a magnificent nickel-plated duplex Deane pump, which did the pumping for the fountain. In the exhibit in machinery Hall were also shown the Deane power boiler feed pumps, the patent direct acting vacuum pumps, the Deane patent independent condenser, etc.

In the first balcony of the Grand Hall was the exhibit of Olney Brothers, Boston and Providence, oil dealers and agents for the Binghamton Oil Refining Company, a New York company. At one end of this exhibit was a pyramid of oil barrels filled with Binghamton "cylindroil." This is a dark-colored oil, and is of extra heavy gravity. It has been known to engineers for the past fifteen years and is popular with them. Another cylinder oil, there shown, was the Mecca Valve "Cylindroil." This is a light amber colored filtered oil.

A very interesting exhibit was that of Charles L. Ireson's self adjusting link belting in the basement of the Exhibition Hall, where the manufacture of this belting was being performed. About a dozen girls were filling an order from a large mill near Boston. The links composing the belt are stamped out of strips of the best oak-tanned leather. They are about one inch long, and two holes are punched in them for the reception of the fastening rivets. These links are put together in a similar manner to the links of a flat-linked chain, and are secured by rivets. Two longitudinal halves of the link belt thus put together are flexibly united by means of a U-shaped joint of leather, thereby allowing the belt to conform to the crown of the pulley, over which it runs. By this hinge the belt can be run over a flat or a round pulley. This belt is run slack over the pulley and considerable strain is thus saved. By having the belt slack there is nearly 20 per cent. more contact with the pulley. This results in a greatly increased conveying and a steady delivered power. As the weight per square foot is several times that of an ordinary belt, it is evident why it can be used slack. This style of belting is especially adapted for electric lighting purposes and all high speed machinery, and is already used by electric lighting companies extensively throughout the country.

Among the exhibits in the machinery department was that of the patent cotton-leather belting made by the Underwood Mfg. Company, of Tolland, Conn. Over the exhibit was a wide belt of the company's make running some of the shafting for the Fair.

This belt is formed by weaving several layers of cotton solidly in one body; it is then placed on pulleys and thoroughly stretched, after which the leather driving service is securely fastened to the cotton body, forming a solid, flexible belt.

They are especially adapted for running high speed machinery, and the company is preparing for a great business in their introduction for use on dynamos, where they have already shown good results, being in use in 200 electric light plants.

This company has appointed Messrs. Warner & Birdseye New England agents, who have opened office in Boston at No. 185 Pearl street.

The Narragansett Machine Company, of Providence, R. I., exhibited in the basement of the Grand Hall screw cutting and other lathes for foot and steam power.

Messrs. Charles A. Schieren & Co., of St. Louis and Boston, had in Machinery Hall a good exhibit of their leather belting and lace leather, products that are well known to the trade.

Messrs. George T. McLaughlin & Co., of Boston, had an excellent exhibit in Machinery Hall of their specialties, one of which was a 12 horse-power Hoadley engine in operation, running a dynamo of the Westinghouse system of electric lighting; and also a turbine water-wheel for electric light plants.

Messrs. Ellis & Cooney, of Boston, exhibited the Ellis automatic lubricator for dynamos, electric machiney, crank pins, cross heads, and in fact for every place where an oil cup is needed.

Mr. George F. Holt, of Boston, New England agent for the Taylor Manufacturing Company, of Chambersburg, Pa., had in Machinery Hall a conspicuous exhibit of automatic, portable, horizontal, vertical engines and boilers, and also of "scalene," said to be the most effective boiler cleansing compound made.

Messrs. Locke Brothers, of Salem, Mass., exhibited the Locke damper regulator and gauge tester, which is a new departure in regulating steam pressure in boilers. It has great sensitiveness and power, and handles the heaviest dampers successfully.

Near by the Emerson Power Scale Company, of Florence, Mass., gave an exhibit of its power scale, which measures and records accurately the amount of power delivered by any shafting with which it is connected. There is no reason why power should not be weighed or measured as well as coal or any other commodity and this little instrument will do it every time.

Mr. Samuel Kidder, of Boston, gave a fine display of leather belting, including a mammoth belt 4 feet wide and 120 feet long, said to be the largest ever made in New England. It weighed about 1,500 pounds, and 100 hides were used in its construction. Mr. Kidder also made a good display of piston and joint engine packings, and a device for fastening the ends of belts together, called the Smith patent belt fastener.

Station No. 2 of the Edison Electric and Illuminating Company of Boston, situated on Bowker street, is almost finished.

The Boston Electric Light Company finds it next to an impossibility to keep pace with the demands for arc and incandescent lights for commercial lighting.

Mr. E. I. Garfield, secretary of the Thomson-Houston Electric Company, Boston, returned to this city after an absence of two weeks on a business trip through Georgia, the Carolinas and Virginia.

Mr. H. D. Stanley, of the Bridgeport Brass Company, and Mr. Geo. T. Manson, of the Okonite Wire Company, of New York, two of the most popular salesmen who have large dealings with the electrical people, were in Boston last week.

From the beautiful city of Newton, Mass., comes the encouraging news that an electric railway has been granted a location and is expected to be running through the main streets soon. The Electric Light and Power Company is intended to furnish the motive power for this railway service. At present the electric light is being rapidly extended and is proving exceedingly popular.

The lights of the Leicester, Mass., Electric Company were started up on Monday, Dec. 19. The system of lighting used is the Thomson-Houston alternating incandescent. The local company will furnish electric light for seven factories, and arrangements have been consummated for lighting two churches, the leading hotel, several stores and quite a number of residences. The incandescent lights will be sold at a price corresponding to gas at $2.25 per 1,000. For the present no street lights will be furnished, but something will be done in this direction in the spring. The power for the dynamos is furnished by the Leicester Wire Company. Mr. H. E. Sargent, president of the wire company just named, is general manager of the Leicester Electric Company. The plant was installed under the direction of Mr. Thos. T. Robinson, of the Thomson-Houston Electric Company.

The Westboro, Mass., Electric Light and Power Company having recently finished its new station, has just completed the transfer of the equipments for dynamo and engine room and steam plant from the former quarters. The station is a handsome building substantially constructed of brick, and is situated in the heart of the town. The equipment of the station includes Armington & Sims engines and steel tubular boilers set with the Jarvis furnace. Both the arc and incandescent systems of the Thomson-Houston Electric Company are used and give thorough satisfaction. Mr. Thomas T. Robinson, of the Thomson-Houston Electric Company, furnished the plans and specifications for the station, and it was under his supervision that the installation of the dynamos, engines, boilers and the remainder of the equipment of the plant was made.

I have been informed that the leading citizens of Portland are strongly in favor of the Postal telegraph, and that a petition to Congress for a system of that kind will soon be prepared, and after the signatures have been affixed it will be forwarded to the Maine delegation.

At the meeting of the Telegraphers' Mutual Aid and Literary Association Saturday, Dec. 3, the following officers were elected for the ensuing term: President, Eugene J. O'Connor; vice-president, Robert E. Tobin; recording secretary, George H. Winston; financial secretary, Hugh W. Gillespie; treasurer, William F. McGrath; sergeant-at-arms, Thomas F. Clark. Arrangements are completed for the third annual reception and ball of the association, which is to be held at Odd Fellows' Hall Feb. 3. Tickets will be ready Tuesday, and may be procured of members of the association.

The Eastern agency of the Heine Water Tube Safety Boiler Company, of Chicago, is under the management of Mr. Robert M. Huston, and located at No. 55 Oliver street, Boston. The Heine safety boiler is attracting a good deal of attention and favorable comment from the electric light people. As evidence in corroboration of this statement, I may mention that the Edison Electric and Illuminating Company has purchased several Heine boilers (aggregating 1,900 h. p.) for its new electric light station on Bowker street, Boston. The Edison Electric and Illuminating Company, of Chicago, has in use Heine boilers, and these have an aggregate of over 2,000 h. p. The Brush Electric Lighting Company, of Columbus, Ohio, has had Heine boilers in use for

some time, and so well pleased is the company with these that it has ordered additional ones of the same make.

The National Hot Water Heater Company, of Boston, for the manufacture of and dealing in boilers and apparatus for heating, and acquiring, holding and selling letters patent on the same and granting licenses thereunder, has received a certificate of organization. Its capital is $10,000. George E. Downe is president and Daniel Simons treasurer.

The Boston fire underwriters have decided that the new heating system could be introduced without particularly increasing the fire risk, but that it would probably need supervising, as in the use of electric lights. In order to get an expression of opinion, however, the underwriters have engaged the services of Prof. Peabody, of the Institute of Technology. He will report to a committee of the underwriters later.

It is reported in Boston that the Attorney General of Massachusetts will proceed immediately to file an information against the Western Union Telegraph Company for the recovery of taxes due the State for 1886 and 1887. The suit for the taxes for 1885 is now in the United States Court, and Assistant Attorney General Bliss is now at Washington to file a motion to take up the case.

The Boston *Globe*, Dec. 19, contained the following: The Metropolitan Board of Police are so well satisfied with the Wilson police signal system now in use at South Boston that they are having the same system placed in the fifth division. The locations for 36 boxes have already been selected, and the wires are now being laid. It is expected that the system will be in working order within a couple of months. Lieutenant Goodwin, of division 6, has been appointed by the board of police as inspector of the police system.

Perhaps I may be allowed to include in my notes the following from the Boston *Herald*:

The growth of electrical journalism has been as wonderful and as rapid as that of the application of electricity itself to lighting, power and other useful purposes. This is well illustrated by a pamphlet just issued by Mr. W. J. Johnston, editor and proprietor of THE ELECTRICAL WORLD, of New York. The story is an interesting one as showing what courage and perseverance will accomplish under even adverse conditions such as usually surround the path of the pioneer in every enterprise. The *Operator* was the name of the progenitor of THE ELECTRICAL WORLD. It was first published on March 1, 1874, as a semi-monthly sheet. At that time the scope of practical electricity was extremely narrow. Mr. Johnston early became interested in the *Operator*, both pecuniarily and as an occasional contributor, and afterward as joint editor and publisher. Finally, his associate in the enterprise, in consideration of $250—to be paid in installments—retired, leaving Mr. Johnston with all the honors and all the responsibilities of the position of editor and proprietor of the *Operator*. At this time he was employed by the Western Union Telegraph Company, having charge of a night office on Sixth avenue. The Western Union had its own official organ, and would not tolerate opposition from one of its employés, so Mr. Johnston was given the choice to sever his connection with the *Operator* or resign. He chose the latter, and then began a struggle which, he says, found him but poorly equipped financially to discharge his indebtedness and carry on his business. But he persevered, worked hard, doing all the work of the paper himself outside of the type-setting and printing. In time the tide of fortune changed. Success crowned his endeavors, and to-day THE ELECTRICAL WORLD is one of the most prosperous of electrical publications in America. W. I. B.

PHILADELPHIA NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
PHILADELPHIA, Pa., Dec. 26, 1887.

H. S. Foster, superintendent of the Millville (New Jersey) Schuyler Electric Light Company, met with a serious accident on Saturday night last at the engine-room of the company. He caught his hand in a switch-board, and the arm and hand were burned to the bone, the flesh bursting in some places. A ring on his little finger was melted.

The electric light companies that furnish the city with illumination by electricity were given notice by the City Councils Thursday that unless the rates should be materially reduced the city would go into the business of electric lighting upon its own account. The matter came up in Common Council upon a motion made by President Lawrence to strike out the first section of the ordinance providing for electric lights, which appropriates $129,280.50 for that purpose. Mr. Lawrence said that he proposed at another time to offer an ordinance providing that the city should build its own plant and furnish its own electric lights. He said that such a plant, he had been informed by persons familiar with the question, could be constructed for $400,000. He had also been informed that the city could furnish its own lights at a cost of 23 cents per lamp per night, and that the city is now paying 55 cents per lamp. The city of Rochester gets its light for 28 cents, Lockport for 32 cents and Columbia for 19 cents per lamp, and a contract has been made by the city of York with the electric lighting company there to furnish light at 16 cents per lamp. President Lawrence quoted other figures to show that Philadelphia is paying excessive rates for its electric lights. With a plant costing $400,000 the gentleman said the the city could furnish 1,500 lights, and that they would not cost more than the city pays now for 500 lights. The gas works are already being pressed to supply enough gas for the use of the people, and a great difficulty has been and is now experienced in supplying the city. If the city should build such a plant as has been suggested the 1,500 lamps could be supplied, and thus the pressure upon the gas works relieved. The city already manufactures gas; why should it not also supply electric lights? The people are now paying 55 cents per lamp for that which could be furnished at a fair profit for 22 cents; and he desired, by having this appropriation stricken out, to notify the electric light companies that they must reduce their rates or else the city will take charge of the lighting itself.

Mr. Zane said that it was not the policy of the city to go into the electric light business, and he could not see how it was possible for the city to build a plant for $400,000 for 1,500 lights. He had been informed that the plants of the companies now furnishing the lights cost $1,500,000. It was not fair to quote rates in other cities, as there might be and probably were exceptional conditions at the places named. The speaker was in favor of compelling the companies to furnish their light at a reasonable rate, but Mr. Lawrence's proposition went too far.

Mr. Hicks said that owing to the fact that the electrical companies were in a combination or trust they would compel the city to pay just what they pleased to ask unless something should be done.

After a lengthy discussion, in which it was evident that the chamber was ready to adopt Mr. Lawrence's motion, it was suggested that enough had been said to show what the temper of the chamber was, and that the appropriation should be passed, and the question for the present of dealing with the companies could be safely left with the Director of Public Works.

Mr. Lawrence said that he was satisfied with that. Enough had been developed to notify the companies that they must lower their rates and come to terms. He therefore withdrew his motion and the item was passed. E.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
CHICAGO, Dec. 24, 1887.

Last week all of the wires contained in a large conduit entering the Board of Trade were cut, and among others were the city police and fire alarm circuits. The Board of Trade was promptly ordered to put the city wires in repair, and in fact the entire expense of repairing the connections had to be met by the Board of Trade. It was ascertained that the reason why the wires were cut was because certain bucket shops were receiving quotations and as the particular source could not be traced it was decided to cut all the wires in the conduits and watch results. This is but one of a large number of schemes that have been tried and have resulted unsuccessfully for depriving the bucket shops of quotations.

Mr. Stephen A. Douglass, of this city, representing New York capitalists, has made a proposition to the city to build elevated railroads upon State street and Madison street, but property owners in large numbers have entered protests and it is not likely that the franchise can be obtained.

There exists an organized society which has for its only object the suppression of all schemes for building elevated railways in the city.

Mr. J. H. Lawrence and H. Hamilton, of the Eureka Improvement Company, operating the Enos Elevated Electric Railway, of St. Paul, Minn., called at THE ELECTRICAL WORLD office this week. Mr. Lawrence states that although many unforeseen difficulties have arisen, the road will be in operation within the next few weeks. It is contemplated to extend the line to Minneapolis, a distance of about ten miles.

The "C. & C." Motor Company have opened an office in the Adams Express Building, in charge of Mr. E. Remington.

The motor companies are getting ready for a busy season this coming spring, when the Edison circuits will be running.

Col. S. G. Lynch, broker, 146 La Salle street, furnishes me the following quotations upon telephone stock:

Bell of Mo.	$160@$165
Central Union	44@ 45
Chicago	375@ 390
Colorado	19@ 21
Cumberland	62@ 65
Great Southern	30@ 32
Iowa Union	28@ 30
Michigan	76@ 77
Missouri and Kansas	68@ 69
Rocky Mountain Bell	40@ 45
Wisconsin	108@ 109

C. H. M.

THE TELEGRAPH.

Knoxville, Tenn.—It is proposed to put in a fire alarm system at Knoxville.

Western Union Gains.—The Western Union test offices are reported to show for the week ending Dec. 17, $212,000, being a gain of $37,500 over the corresponding week of 1886.

Fire Alarm Telegraphs.—The Gamewell Fire Alarm Telegraph Company has contracted to put in a fire alarm system at Raleigh, N. C., to cost $2,890, and has tendered for a system at Mobile, Ala., to cost $2,825.

French Cable vs. Western Union.—Judge Wallace, in the United States Circuit Court, this city, on Dec. 21, issued an injunction restraining the French-American Cable Company from removing the six lines of wires owned by the Western Union Telegraph Company between Cape Cod and Boston, now upon the poles of the cable company between New York, Taunton, Boston and Cape Cod.

Bucket Shops in Tennessee.—A special dispatch from Nashville, of Dec. 21, says: The Supreme Court yesterday passed upon the liability of bucket shops for money lost by customers dealing in futures. Mrs. Sallie Reese brought suit in the Chancery Court to recover $2,000 lost by her husband while speculating in the bucket shop operated by S. H. Bell and others. She was awarded judgment for the amount and the defendants appealed. The proof showed that in Reese's transactions he won more money than he lost. Upon this the Supreme Court reversed the judgment. In doing so the Court held that in all bucket shop cases where suit is brought to recover moneys lost the defendants shall be allowed to deduct all amounts paid complainants as their winning, and only the net amount lost after deducting winnings can be recovered from the defendants.

Western Union Taxes.—A dispatch of Dec. 19 from Washington says: The reading of opinions in the United Supreme Court to-day occupied only twenty minutes, and no decisions of general importance were rendered. A motion was made by the Attorney-General of Massachusetts to advance the case of that State against the Western Union Telegraph Company. This case involves the validity and constitutionality of any tax assessed under the tax system of Massachusetts upon telegraph companies which accepted the aid provided for in an act of Congress approved July 22, 1866, and entitled "An act to aid in the construction of telegraph lines and to secure to the government the use of the same for postal, military and other purposes." (Revised Statutes, section 5,263.) The Western Union Company maintains that the system of taxation under which the tax complained of is assessed as a franchise tax is unconstitutional and illegal. The amount of money directly involved is about $40,000, but the same questions are raised by the tax systems of a number of other States.

THE TELEPHONE.

Drawbaugh Stock.—The stock of the Drawbaugh telephone syndicate has been entirely withdrawn from the market. The outlook for a decision in the Supreme Court against the Bell Telephone Company seems to be so favorable that the owners of the stock prefer to wait and take their chances.—*Wall Street News.*

Meeting of Telephone Experts.—A meeting of telephone experts was held last week in the Telephone Building, in this city, to discuss the most desirable forms and arrangement of office exchange apparatus. The meeting was presided over by Mr. E. J. Hall, Jr., and among those present were: H. Metzger, of Pittsburgh; C. C. Scribner, E. M. Barton, B. E. Sunny, F. G. Beach, of Chicago; C. F. Wilson, of Columbus; T. D. Lockwood, W. J. Denver, I. H. Farnham, of Boston; W. W. Smith, of Kansas City; H. L. Thayer, A. S. Hibbard, J. A. Seely, J. P. Davis, of this city, and W. D. Sargent, of Brooklyn. The meeting ended in a banquet, given at the Hotel Brunswick. A private report of the proceedings of the conference will be printed.

THE ELECTRIC LIGHT.

Greensboro, N. C.—The Thomson-Houston plant at Greensboro is being doubled in capacity.

Fredericksburg, Va.—The Rappahannock Electric Light and Power Company are doubling the capacity of their plant.

Richmond, Va.—It is reported that the Virginia Electric Light and Power Company will begin working its plant very soon at Richmond.

The Waterhouse System of electric lighting has been awarded a gold medal at the Massachusetts Charitable Mechanics' Association annual exhibition.

Lowell Depot, Boston.—The large restaurant of G. C. Evans, opposite the Lowell Depot, Boston, is to be lighted by the Loomis incandescent electric system.

Salem, O.—Mr. D. L. Davis has secured a contract for lighting the city of Salem for 5 years with 55 1,200 c. p. arc lights. The plant must be running by April 1st, 1888.

Bessemer, Ala.—The Bessemer Electric Light and Power Company are now erecting a temporary building for their plant, and are to put up a permanent brick structure on Alabama avenue.

Plainfield, N. J.—The Westinghouse alternating system has been applied to lighting the public art gallery at Plainfield, where F. X. Schoonmaker has placed a fine collection of enamels and cloisonné ware.

Pine Bluff, Ark.—A company, which has been organized by Mr. W. I. Wark at Pine Bluff, to erect an incandescent plant, is, it is said, to begin with a capital stock of $20,000, instead of $10,000, as at first intended.

The Adelaide Exhibition.—Woodhouse & Rawson, Ltd., of London, have been awarded the diploma of the first order of merit at the Adelaide (South Australia) Exhibition for their exhibits of electrical fittings, etc.

Haw Mill, N. C.—Mr. T. M. Holt, proprietor of the Granite Cotton Mills, Haw River, reports that he has had an isolated Edison plant in operation at the new weave mill for about a month, and that it is giving satisfaction.

Camden, N. Y.—The Camden Electric Light Company, using the Loomis system, start up this week their first machine, of 250-light capacity. The inhabitants are reported so eager for the light that the company will soon be compelled to increase its facilities.

Lawrence, Mass.—The Jarvis Engineering Company, of Boston, have received a contract to erect a chimney for the Edison Illuminating Company, of Lawrence, Mass. This chimney will be built in the new style, which is claimed to cost about one-third less than the usual style.

Springfield, O.—The Warder, Bushnell & Glessner Company, manufacturers of "Champion" reapers, mowers, etc., are putting in two 500-light Mather incandescent machines and one 30-light Waterhouse arc machine. Mr. C. A. Bauer, the general manager, expects to have the plant running by Jan. 1.

Newburyport, Mass.—The Newburyport Electric Light Company, after giving a trial to the long stroke type of engine, is to put in a direct acting engine. It has ordered a 100 h. p. Armington & Sims engine from the Jarvis Engineering Company and will set a 125 h. p. tubular boiler with the Jarvis furnace.

The Silvey System.—The Lima, O., *Gazette* of Dec. 16 notes the fact that the Silvey Electric Company there has installed part of the machinery for its works, and expects to have the plant in operation by the beginning of the year. It is said that there are now some forty plants of the Silvey lighting system in operation successfully in the States of Arkansas, Tennessee, Illinois, Ohio and Indiana, and that fifteen of these are in Cincinnati. The company will make a specialty of locomotive head-lights.

The Copper-Coated Carbon Combination.—Messrs. E. I. Garfield, W. H. Boulton and Geo. F. Porter, the executive committee of the combination formed to oppose the exclusive claims of the Brush Electric Company to the manufacture of copper-coated carbons, have issued a circular on the subject to all who are interested. They ask financial aid from each person or company concerned, to the extent of $10, for the defence of the suit brought against the Faraday Company, and say that they believe that the matter can be successfully fought out and that "to this end it is almost imperative that your local company give pecuniary aid to the amount above stated, and as much more as you feel interested."

Portsmouth, N. H.—The Portsmouth Electric Light Company, F. S. Palmer superintendent, now has a Thomson-Houston 30-light machine in use; it has also put in a 500-light alternating machine of the Thomson-Houston make, which runs very smoothly and gives unusual satisfaction. The company has also just bought a new 100 h. p. Armington-Sims engine, which will make a total of 200 h. p. in engines. Mr. Kimball has put in for the company the first regularly equipped switch-board in New Eng

land for the alternating machines, and the station has also the first junction box for alternating feeders. This provides safety catches for each feeder. The company is putting in new lights every day and is expected to do a first-class business. The superintendent has a nice new office, and will have every appliance to make the station complete in all respects.

APPLICATIONS OF POWER.

Cincinnati, O.—The Daft system has been adopted for the Oak Street Railway, Cincinnati.

Galveston, Tex.—The Galveston Street Railway Company has secured permission to operate its cars by electricity.

Little Rock, Ark.—The City Electric Street Railway Company, of Little Rock, has been incorporated by H. B. Adams, J. B. Jones and M. W. Benjamin, with a capital stock of $200,000. The work of constructing the road will begin very soon.

St. Louis, Mo.—It is reported from St. Louis that Mr. Chas. Green, president of the People's Railway Company, and Mr. Christian Peper, of the St. Louis Railroad Company, are both in favor of electricity for street cars, believing in the applicability of the storage battery.

Anniston, Ala.—The electric plant for the Anniston Street Railway Company is to be located at the corner of 11th and Moore streets. In addition to operating its road by electricity, the company will furnish power for manufacturers, and will run arc and incandescent lights.

Mansfield, O.—The Mansfield electric railway using the Daft system embraces 4½ miles of track and includes grades of 7 and 8 per cent. The cars, loaded with 60 or 70 people, go up hill at the rate of 4½ miles an hour, and start and stop at any point. At the present time five cars are in use, lighted as well as propelled by electricity. It is said that the objections made at first to the poles and overhead wires are no longer heard, and that the system works very satisfactorily.

St. Joseph, Mo.—The *Street Railway Gazette* quotes the following from a correspondent about St. Joseph, where Sprague motors are being used: "The round trip was made in eight minutes, at a speed of about ten miles an hour. There now appears to be no doubt of the success of the Sprague system. There is scarcely any noise attaching to the running of the cars, and the cars glide along more smoothly than either cable or horse cars, and resemble the running of cars over an elevated road. It will be a big thing for the St. Joseph and Union Street car line when the entire road is operated by electricity."

New York City.—A good deal is heard in New York at the present time about new roads and increased facilities of travel. One road is projected to run from down town to the residential part of the city through the proposed new thoroughfare on Elm street, and to use electricity. Another scheme contemplates the boring of the tunnel under the East River between New York and Brooklyn, to be used for railway purposes. A railway would be provided and electric motors would be employed.

MISCELLANEOUS NOTES.

Electric Fare Boxes.—Mr. W. A. Crowdus, of Dallas, Tex., is making efforts at Nashville, Tenn., to organize a company with a capital stock of $100,000 to manufacture his electric fare boxes and registers for street cars.

San Francisco, Cal.—The Callender Insulating and Waterproofing Company have appointed the Electric Improvement Company, 217 Sansom street, San Francisco, agents for the sale of their bitite insulated house wires and cables, as well as for their Trinidad wires, for the Pacific slope. The company has for some time been shipping considerable quantities of its wire to the Pacific coast.

A Terrific Explosion at Rochester, N. Y., was caused last week by the leakage into the sewers of 14,000 gallons of naphtha, which was being conveyed to the Municipal Gas Company by pipe, in the usual way. Three big flour mills were totally demolished, three persons were killed and twenty were injured. The first explosion was followed by others in different directions in the sewers, and for some time the greatest consternation prevailed. The whole sewerage system of Rochester seems to have suffered.

Prices of Gas.—The following are the prices charged for gas in the principal cities of the country: New York, $1.25; Brooklyn, $1.60; Philadelphia, $1.60; Baltimore (net price) $1.50; Boston, $1.50; St. Louis, $1.50; Chicago, $1.50; Cincinnati, $1.52; Cleveland, $1.40; Pittsburgh, $1; Buffalo, $1.50; Detroit, $1.75; Milwaukee, $1.40; Indianapolis, $1.80; New Orleans, $3.20; San Francisco, $2; Richmond, $1.50; Charleston, $2.25; Nashville, $2.10; Minneapolis, $1.80; New Haven, $1.70; Washington, $1.43.

A New Drawbaugh Invention.—A special dispatch from Harrisburg, Pa., of Dec. 18, has the following: Daniel Drawbaugh, who claims to have invented a telephone prior to Mr. Bell, and whose claim to priority of invention is being contested in the United States Supreme Court, has completed an electrical contrivance at his little shop near this city, which he maintains will enable the detection of the approach of an army or of ships on the ocean within a distance of ten miles from the location of the instrument. Mr. Drawbaugh says the nearness of troops would be indicated by a peculiar motion of the instrument caused by the vibration of the earth. In case of the approach of a vessel, he states that the resistance of the water to the vessel causes sufficient friction to establish communication with the contrivance.

BUSINESS NOTICES.

Hine & Robertson, 45 Cortlandt st., N. Y., offer special inducements to electric light supert's and engineers to use "Eureka" packing and other specialties. It will pay to address them.

Jordan & Gottfried, 208 Canal St., N. Y., carry a complete stock of iron and brass machine and wood screws, bolt cap and set screws, taps, dies, files, twist drills, brass and rubber tubing, rod and sheet copper, brass, German silver, steel and iron wire, shafting, tools, etc.

Increasing Trade with Mexico.—Mr. Bell, the superintendent of the foreign mail service, reports that the exports from the United States through El Paso, Tex., to Mexico in 1886 to September were $380,000. In 1887 to September they had increased to $1,250,000. Manufacturers looking for that trade should not hesitate to use the columns of *El Anunciador*, a monthly export journal published by the Dumont Company, of New York, and printed in the Spanish language, which has a large guaranteed circulation among the prominent commercial firms of Mexico and Central America.

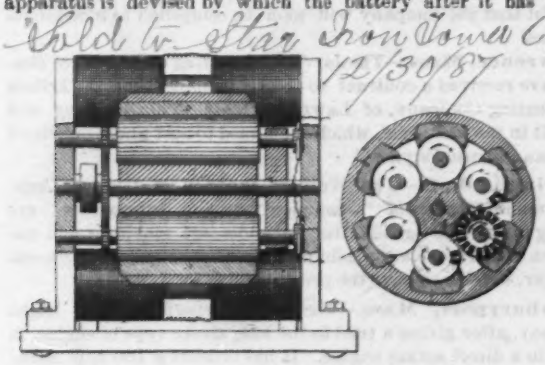
OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED DECEMBER 20, 1887.

374,948. Clip for Suspending Cables; T. T. Eckert, New York, N. Y. Application filed May 31, 1887. The hooks which embrace the cable and the supporting wire are provided with lips which overlap each other and thus prevent the cables from becoming separated.

374,959. Dynamo; J. Gray, Medford, Mass. Application filed Nov. 26, 1886. The field magnet is constructed with one annular and one central pole, and each having a number of corresponding recesses, which receive an armature rotating within the same and so arranged relatively to each other that their opposite poles act upon each other by attraction, and thereby assist each other in their motion between the poles of the field magnet. Thus, beyond a certain point, no additional force will be consumed in overcoming the resistance of the field. See illustration.

375,001. Electro-Pneumatic Mechanical Movement; H. L. Roosevelt, Deceased; A. Roosevelt, Executor, New York, N. Y. Application filed April 25, 1881. The apparatus is arranged to be moved in two directions by means of currents sent through different circuits, and as it is not desirable that the batteries should remain constantly in circuit an apparatus is devised by which the battery after it has performed its work has its circuit broken and is arranged to then operate the aparatus in the opposite direction.



374,959. DYNAMO-ELECTRIC MACHINE.

375,003. Railway Signal; J. H. Gibson, New York, Assignor to C. E. Hubbell, Syracuse, N. Y. Application filed June 16, 1887. Track instruments are arranged to be operated by the wheels of the train, and to indicate in which direction the train is moving.

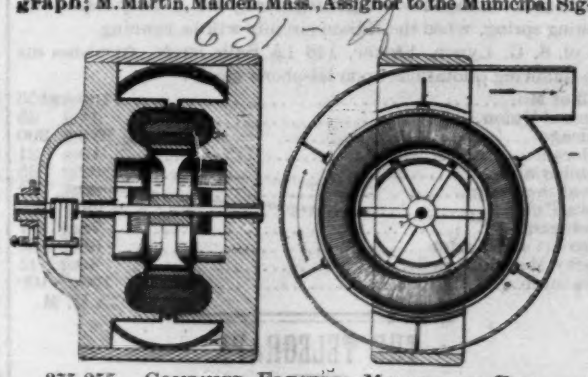
375,007. Galvanic Battery; J. Serson, Boston, Mass., Assignor to J. O. Whitten, same place. Application filed July 6, 1887. Free mercury is contained in a channel in which rests the zinc, and reinforcing materials are stored in cups to reinforce the battery as it expends its force.

375,014. Cut-out for Electrical Distribution Apparatus; M. M. M. Slattery, Woburn, Mass., Assignor of one-half to the Fort Wayne Jenney Electric Light Co., of Fort Wayne, Ind. Application filed March 2, 1887. In a system in which groups of translating devices are operated in series, an electro-magnet is placed in circuit in multiple with the translating device group, which circuit is open during the normal operation of the devices, and a cut-off device controlled by the magnet cuts the translating devices out of circuit on the loss of magnetism in the magnet. See illustration.

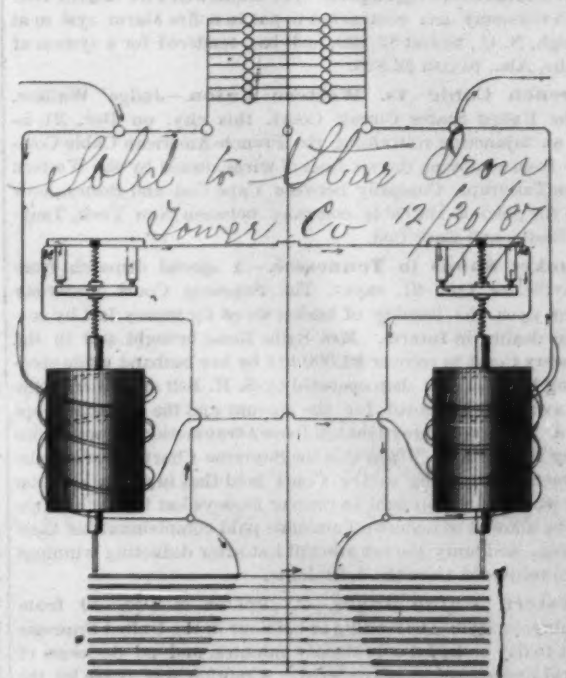
375,022. Electric Welding Method; E. Thomson, Lynn, Mass. Application filed Aug. 10, 1887. The ends of the metal to be welded are first rounded and then brought together under pressure. The current is passed through them, and just before an incipient welding the pressure is increased to force the metal to flow.

375,034. Carbon Electrode for Galvanic Batteries; C. H. Wilder, Natick, Mass., Assignor to the Hub Carbon Co., of Kennebunk, Me. Application filed Feb. 17, 1887. Clean gas coke is pulverized and mixed with two parts of bitumen or roofer's pitch, and one part of coal tar from gas works until the mass is of the consistency of mortar. It is then pressed into molds, burned, and afterwards allowed to cool slowly, producing a tenacious and solid body of carbon.

(1) 375,083. Signal Box; (2) 375,299. Municipal Telegraph; M. Martin, Malden, Mass., Assignor to the Municipal Signal Co., Portsmouth, N. H. Applications filed respectively Dec. 22 and July 6, 1886. (1) Devices are employed for preventing the operator from interfering with the sending in of a signal after he has once started the mechanism. (2) The transmitter is operated by a pull arranged to be actuated by a key from the outside. The shape of the key used is indicated by proper mechanism.



375,255. COMBINED ELECTRIC MOTOR AND FAN.



375,014. CUT-OUT FOR ELECTRICAL DISTRIBUTING APPARATUS.

375,117. Combined Gas and Electric Light Fixture; S. Bergmann, New York, N. Y. Application filed Oct. 31, 1884. Two rigid arms or brackets are pivoted together, one conveying gas, the other an electric conductor. They are adapted to swing together, and one terminates in a gas tip and the other in an incandescent globe. See illustration.

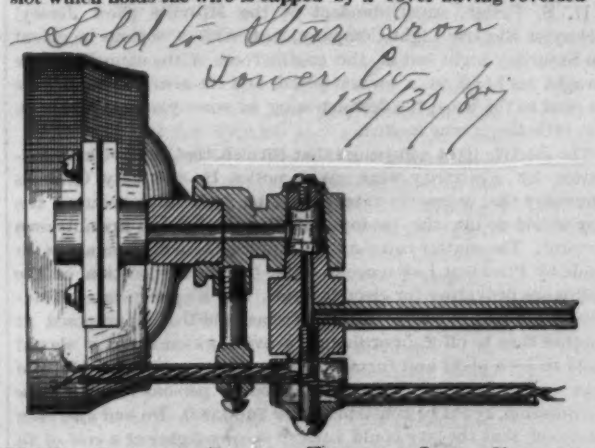
375,118. Electric Gas Lighting Apparatus; C. B. Bosworth, Everett, Mass., Assignor to the Electric Gas Lighting Co. of Maine. Application filed Jan. 19, 1887. This invention consists in improvements in the form, construction and arrangements of the elements of burners, particularly in the gas cock, circuit changing devices, cam and ratchet wheels.

375,238. Electrical Circuit Closer for Railway Cars; M. M. Welch, Atlanta, Ga. Application filed Sept. 14, 1887. The contacts are mounted on springs which are in circuit and normally hold the contacts apart. The two conductors which run through the cars in a single cord are connected with the springs, and when pulled bring the contacts together and complete the circuit.

(1) 375,242; (2) 375,243. Thermo-Electric Generators; E. G. Acheson, Pittsburgh, Pa. Applications filed respectively Aug. 27 and Sept. 2, 1887. For description see THE ELECTRICAL WORLD, p. 343, this issue.

375,255. Combined Electric Motor and Fan; H. H. Blades, Detroit, Mich. Application filed Feb. 21, 1887. The blades of the fan are attached directly to the periphery of the armature and the field magnets; pole pieces and frame of the motor serve as the fan case. See illustration.

375,276. Insulator; E. C. Emery, San Diego, Cal. Application filed Sept. 1, 1887. A base having a J-shaped slot which holds the wire is capped by a cover having reversed slots diametrically opposite the slot in the base. When the parts are in position the wire is securely held.



275,117. COMBINED GAS AND ELECTRIC LIGHT FIXTURE.

375,280. Tip for Telephone Cords; F. A. Forbes, Detroit, Mich. Application filed Sept. 20, 1887. The cord passes through a sleeve which grips it, and the base end of the cord or wire passes around a pin or extension of the sleeve and is folded back into the sleeve.

375,295. Insulated Conductor; A. Kissel, Salem, Assignor to the Adamanta Manufacturing Company, of Boston, Mass. Application filed Sept. 5, 1887. The wire is covered with "Adamanta rubber," a compound of resin, caustic alkaline earth, oil and sulphur.

375,315. Mechanical Telephone; W. H. Eastman and D. J. Adams, Concord, Assignors, by mesne assignments, to the Eureka Telephone Company, Nashua, N. H. Application filed May 4, 1887. Two conical diaphragms are arranged with their apexes near to the centre of the receiving diaphragm. They are nearly parallel and are stretched over a wooden ring.

375,316. Mechanical Telephone Exchange; W. H. Eastman, Concord, Assignor, by mesne assessments, to the Eureka Telephone Co., Nashua, N. H. Application filed May 9, 1887. Any two subscribers' lines running from the central office may be connected into a single line by a loose cord, which, after the connection is made, is given the required tension by suitable devices.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patents issued since 1866—can be had from this office for 25 cents. Give the date and number of patent desired, and address Johnston's Patent Agency, Potter Building, New York.